ANNA UNIVERSITY OF TECHNOLOGY MADURAI

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

III to VIII SEMESTERS CURRICULUM AND SYLLABI

(Applicable to the students admitted from the Academic year 2010 – 2011 onwards)

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	10177MA301	Transforms and Partial Differential	3	1	0	4
2.	10133EE302	Measurements & Instrumentation	3	0	0	3
3.	10133EE303	Electromagnetic Theory	3	1	0	4
4.	10177GE001	Environmental Science and Engineering	3	0	0	3
5.	10133EE305	Electronic Devices & Circuits	3	0	0	3
6.	10133EE306	Data Structures and Algorithms	3	1	0	4
PRACTICAL						
7.	10133EE307	Electron Devices and Circuits Laboratory	0	0	3	2
8.	10133EE308	Data Structures and Algorithms Laboratory	0	0	3	2
9.	10133EE309	Measurements & Instrumentation Laboratory	0	0	3	2
		TOTAL	**18**	**3**	**9**	**27**

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	10177MA401	Numerical Methods	3	1	0	4
2.	10133EE402	Electrical Machines – I	3	1	0	4
3.	10133EE403	Power Plant Engineering	3	0	0	3
4.	10133IC401	Control Systems	3	1	0	4
5.	10133EE405	Linear Integrated Circuits and applications	3	0	0	3
6.	10133EE406	Digital Logic Circuits	3	0	0	3
PRACTICAL						
7.	10133IC407	Control Systems Laboratory	0	0	3	2
8.	10133EE408	Linear and Digital Integrated Circuits Laboratory	0	0	3	2
9.	10133EE409	Electrical Machines Laboratory – I	0	0	3	2
		TOTAL	**18**	**3**	**9**	**27**

SEMESTER V

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	10144EE501	Communication Engineering	3	0	0	3
2.	10144EC502	Digital Signal Processing	3	1	0	4
3.	10133EC506	Microprocessors & Microcontroller	3	0	0	3
4.	10144EE504	Power Electronics	3	0	0	3
5.	10133EE505	Electrical Machines II	3	1	0	4
6.	10133EE506	Transmission and Distribution	3	1	0	4
PRACTICAL						
7.	10133EE507	Microprocessor and Micro controller Laboratory	0	0	3	2
8.	10177GE002	Communication Skills Laboratory	0	0	4	2
9.	10133EE509	Electrical Machines II Laboratory	0	0	3	2
		TOTAL	**18**	**3**	**10**	**27**

SEMESTER VI

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	10133EE601	Power System Analysis	3	1	0	4
2.	10133EE602	Solid State Drives	3	0	0	3
3.	10133EE603	High Voltage Engineering	3	0	0	3
4.	10133CS304	Object Oriented Programming	3	0	0	3
5.	10133EE605	Design of Electrical Machines	3	1	0	4
6.	10144CS503	Computer Networks	3	0	0	3
7.	E01	Elective I	3	0	0	3
PRACTICAL						
8.	10133CS309	Object Oriented Programming Laboratory	0	0	3	2
9.	10133EE609	Power Electronics Laboratory	0	0	2	2
10.	10133EE610	Presentation Skills and Technical Seminar	0	0	2	1
		TOTAL	**21**	**2**	**7**	**28**

SEMESTER VII

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	10133EE701	Power System Operation and Control	3	0	0	3
2.	10133EE702	Protection & Switchgear	3	0	0	3
3.	10144CSE26	Embedded system	3	0	0	3
4.	10177GE003	Principles of Management	3	0	0	3
5.	10133EE705	Renewable Energy Sources	3	0	0	3
6.	E02	Elective – II	3	0	0	3
PRACTICAL						
7.	10133EE707	Power System Simulation Laboratory	0	0	3	2
9.	10133EE708	Comprehension	0	0	2	1
		TOTAL	**18**	**0**	**5**	**21**

SEMESTER VIII

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	10133EE801	Electric Energy Generation, Utilization and Conservation	3	0	0	3
2.	E03	Elective – III	3	0	0	3
3.	E04	Elective – IV	3	0	0	3
PRACTICAL						
4.	10133EE804	Project Work-Viva Voce	0	0	12	6
		TOTAL	**9**	**0**	**12**	**15**

ELECTRICAL & ELECTRONICS ENGINEERING

LIST OF ELECTIVES

ELECTIVE I – E01

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	10133EI704	Fibre Optics and Laser Instruments	3	0	0	3
2.	10144EEE12	Visual Languages and Applications	3	0	0	3
3.	10133IC604	Advanced Control System	3	0	0	3
4.	10133EEE14	Robotics & Automation	3	0	0	3
5.	10177GE005	Professional Ethics and Human values	3	0	0	3
6.	10133EEE16	Power System Transients	3	0	0	3

ELECTIVE II – E02

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
7.	10133EI606	Bio-Medical Instrumentation	3	0	0	3
8.	10133EEE22	Intelligent Control	3	0	0	3
9.	10133EEE23	Power System Dynamics	3	0	0	3
10.	10133EEE24	Computer Architecture	3	0	0	3
11.	10133EEE25	Special Electrical Machines	3	0	0	3

ELECTIVE III – E03

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
12.	10133EEE31	Power Quality	3	0	0	3
13.	10133CS405	Operating Systems	3	0	0	3
14.	10133EEE33	Operations Research	3	0	0	3
15.	10144EC605	VLSI Design	3	0	0	3
16.	10133EEE35	HVDC Transmission	3	0	0	3

ELECTIVE IV – E04

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
17.	10177GE006	Fundamental of Nanoscience	3	0	0	3
18.	10133EEE42	Micro Electro Mechanical Systems	3	0	0	3
19.	10133EEE43	Software for Circuits Simulation	3	0	0	3
20.	10133EEE44	CAD of Electrical apparatus	3	0	0	3
21.	10133EEE45	Flexible AC Transmission Systems	3	0	0	3

L T PC

10177MA301 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS **3 1 0 4**

(Common to all branches)

OBJECTIVES

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differtial Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electrooptics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT I 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.

UNIT II 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.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS **9**

Formation of partial differential equations - Lagrange's linear equation - Solution of standard types of first order partial differential equations – Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **9**

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat equation (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

UNIT V 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 PERIODS

TEXTBOOKS

1. Grewal B.S, "Higher Engineering Mathematics", 39th Edition, Khanna Publishers, Delhi, 2007

REFERENCE BOOKS

1. Bali.N.P. and Manish Goyal "A Textbook of Engineering Mathematics", Seventh Edition, Laxmi Publications (P) Ltd.
2. Ramana.B.V. "Higher Engineering Mathematics" Tata Mc-GrawHill Publishing Company Limited, New Delhi.
3. Glyn James, "Advanced Modern Engineering Mathematics", Third edition – Pearson education – 2007.
4. Erwin Kreyszig "Advanced Engineering Mathematic" Eighth Edition – Wiley India – 2007.

L T PC

10133EE302 MEASUREMENTS AND INSTRUMENTATION 3 0 0 3

AIM

To provide adequate knowledge in electrical instruments and measurements techniques.

OBJECTIVES

To make the student have a clear knowledge of the basic laws governing the operation of the instruments, relevant circuits and their working.

i. Introduction to general instrument system, error, calibration etc.

ii. Emphasis is laid on analog and digital techniques used to measure voltage, current, energy and power etc.

iii. To have an adequate knowledge of comparison methods of measurement.

iv. Elaborate discussion about storage & display devices.

v. Exposure to various transducers and data acquisition system.

UNIT I INTRODUCTION 9

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration.

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS 9

Principle and types of analog voltmeters, ammeters, multimeters – Single and three phase wattmeters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

UNIT III COMPARISON METHODS OF MEASUREMENTS 9

D.C & A.C potentiometers, D.C & A.C bridges, transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic interference – Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & dot matrix display – Data Loggers

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive transducers – Piezoelectric, optical and digital transducers – Elements of data acquisition system –Smart sensors.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Doebelin.E.O, “Measurement Systems – Application and Design”, Tata McGraw Hill publishing company, 2003.
2. Sawhney.A.K, “A Course in Electrical & Electronic Measurements & Instrumentation”, Dhanpat Rai and Co, 2004.

REFERENCE BOOKS

1. Bouwens.A.J, “Digital Instrumentation”, Tata McGraw Hill, 1997.
2. Moorthy.D.V.S, “Transducers and Instrumentation”, Prentice Hall of India Pvt Ltd, 2007.
3. Kalsi.H.S, “Electronic Instrumentation”, Tata McGraw Hill, II Edition 2004.
4. Martin Reissland, “Electrical Measurements” New Age International (P) Ltd., Delhi, 2001.
5. J. B. Gupta, “A Course in Electronic and Electrical Measurements”, S. K. Kataria & Sons, Delhi, 2003.

L T PC

10133EE303 ELECTROMAGNETIC THEORY 3 1 0 4

AIM

This subject aims to provide the student an understanding of the fundamentals of electromagnetic fields and their applications in Electrical Engineering.

OBJECTIVES

To impart knowledge on

i. Concepts of electrostatics, electrical potential, energy density and their applications.

ii. Concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.

iii. Faraday's laws, induced emf and their applications.

iv. Concepts of electromagnetic waves and Poynting vector.

UNIT I INTRODUCTION 8

Sources and effects of electromagnetic fields – Vector fields – Different co-ordinate systems-vector calculus – Gradient, Divergence and Curl - Divergence theorem – Stoke's theorem.

UNIT II ELECTROSTATICS 10

Coulomb's Law – Electric field intensity – Field due to point and continuous charges – Gauss's law and application – Electric potential – Electric field and equipotential plots – Electric field in free space, conductors, dielectric -Dielectric polarization – Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations – Capacitance- Energy density.

UNIT III MAGNETOSTATICS 9

Lorentz Law of force, magnetic field intensity – Biot–savart Law - Ampere's Law – Magnetic field due to straight conductors, circular loop, infinite sheet of current – Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization – Magnetic field in multiple media – Boundary conditions – Scalar and vector potential – Magnetic force – Torque – Inductance – Energy density – Magnetic circuits.

UNIT IV ELECTRODYNAMIC FIELDS 8

Faraday's laws, induced emf – Transformer and motional EMF – Forces and Energy in quasi-stationary Electromagnetic Fields - Maxwell's equations (differential and integral forms) – Displacement current – Relation between field theory and circuit theory.

UNIT V ELECTROMAGNETIC WAVES 9

Generation – Electro Magnetic Wave equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors-skin depth, Poynting vector – Plane wave reflection and refraction – Transmission lines – Line equations – Input impedances – Standing wave ratio and power.

L :45 T :15 TOTAL:60 PERIODS

TEXT BOOKS

1. Mathew N. O. Sadiku, “Elements of Electromagnetics”, Oxford University press Inc. First India edition, 2007.
2. Ashutosh Pramanik, “Electromagnetism – Theory and Applications”, Prentice-Hall of India Private Limited, New Delhi, 2006.

REFERENCE BOOKS

1. Joseph. A.Edminister, “Theory and Problems of Electromagnetics”, Second edition, Schaum Series, Tata McGraw Hill, 1993.
2. William .H.Hayt, “Engineering Electromagnetics” Tata McGraw Hill edition, 2001.
3. Kraus and Fleish, “Electromagnetics with Applications”, McGraw Hill International Editions, Fifth Edition, 1999.

L T PC

10177GE001 ENVIRONMENTAL SCIENCE AND ENGINEERING 3 0 0 3

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.

OBJECTIVES

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.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 9

Definition, Scope and Importance – Need For Public Awareness – Forest Resources:- Use and Over - Exploitation, Deforestation, Case Studies, Timber Extraction, Mining, Dams and their Ground Water, Floods, Drought, Conflicts Over Water, Dams – Benefits and Problems – Mineral Resources:- Use Effects on Forests and Tribal People – Water Resources:- Use and Over-Utilization of Surface and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies – Food Resources: World Food Problems, Changes caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer- Pesticide Problems, Water Logging, salinity, Case Studies – Energy Resources:- Growing Energy Needs, Renewable and Non Renewable Energy Sources, Use of Alternate Energy Sources, Case Studies – Land Resources:- Land as a Resource, Land Degradation, Man Induced Landslides, Soil Erosion and Desertification – Role of an Individual in Conservation of Natural Resources – Equitable use of

Resources for Sustainable Lifestyles. Field Study of Local Area to Document Environmental assets – River/Forest/Grassland/Hill/ Mountain.

UNIT II ECOSYSTEMS AND BIODIVERSITY 9

Concepts 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 and Birds - Field Study of Simple Ecosystems – Pond, River, Hill Slopes, etc.

UNIT III ENVIRONMENTAL POLLUTION 9

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

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

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.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 9

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.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Masters, G.M., “Introduction to Environmental Engineering and Science”, Pearson Education Pvt., Ltd., 2nd Edition, 2004.
2. Miller, T.G. Jr., “Environmental Science”, Wadsworth Pub. Co.
3. Townsend C., Harper, J. and Begon, M., “Essentials of Ecology”, Blackwell Science, 2003.
4. Trivedi, R.K., and Goel, P.K., “Introduction to Air Pollution”, Techno- Science Publications.

REFERENCE BOOKS

1. Erach, B., “The Biodiversity of India”, Mapin Publishing Pvt. Ltd., Ahmedabad, India.
1. Trivedi, R.K., “Handbook of Environmental Law’s, Rules, Guidelines,Compliances and Standards”, Vol - I and II, Envio Media.
2. Cunningham., Cooper, W.P. and Gorhani, T.H., “Environmental Encyclopedia”, Jaico Publishing House, Mumbai, 2001.
4. Wages, K.D., “Environmental Management”, W.B. Saunders Co., Philadelphia, USA, 1998.

L T P C

10133EE305 ELECTRONIC DEVICES AND CIRCUITS 3 0 0 3

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

UNIT I PN DIODE AND ITS APPLICATIONS 9

PH junction diode-VI characteristics – Rd, temperature effects – Drift ad diffusion currents – switching – Rectifiers: HWR, FWR, BR, filters-Zener diode – VI characteristics, Regulators (series and shunt), LED, LCD characteristics and applications.

UNIT II BJT AND ITS APPLICATIONS 9

Junction transistor – Transistor construction – Input and output characteristics – CE, CB and CC configurations – hybrid model – Analytical expressions – switching – RF application – Power transistors – Opto couplers.

UNIT III FET AND ITS APPLICATIONS 9

FET – VI characteristics, VP, JFET – small signal model – LF and HF equivalent circuits – CS and CD amplifiers –cascade and cascade – Darlington connection – MOSFET - Characteristics – enhancement and depletion

UNIT IV AMPLIFIERS AND OSCILLATORS 9

Differential amplifiers: CM and DM – condition for ofc-feedback amplifiers – stability – Voltage / current, series / shunt feedback – oscillators – LC, RC, crystal

UNIT V PULSE CIRCUITS 9

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

TOTAL : 45 PERIODS

TEXT BOOKS

1.Milman & Halkias, " Electronic Devices and Circuits",TataMcGraw Hill, 2007

2. Rashid, "Microelectronic circuits" Thomson Publication, 1999

3. B.P.Singh & Rekha Sing, "Electronic Devices and Integrated Circuits" Pearson Education, 2006.

4.Floyd.T.L, " Electronic Devices and Circuits",Pearson Education,2003.

5.Boylsted and Nashelsky, " Electronic Devices and Circuit Theory", PHI, 1999.

REFERENCE BOOKS

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

2.Paynter, "Introductory lectronic devices and circuits, PHI,2006.

3.David Bell "Electronic Devices and Circuits" ,PHI,2007

L T PC

10133EE306 DATA STRUCTURES AND ALGORITHMS 3 1 0 4

(Common to EEE, EIE & ICE)

AIM

To master the design and applications of linear, tree, and graph structures. To understand various algorithm design and analysis techniques.

UNIT I LINEAR STRUCTURES 9

Abstract Data Types (ADT) – List ADT – array-based implementation – linked list implementation – cursor-based linked lists – doubly-linked lists – applications of lists – Stack ADT – Queue ADT – circular queue implementation – Applications of stacks and queues

UNIT II TREE STRUCTURES 9

Need for non-linear structures – Tree ADT – tree traversals – left child right sibling data structures for general trees – Binary Tree ADT – expression trees – applications of trees – binary search tree ADT

UNIT III BALANCED SEARCH TREES AND INDEXING 9

AVL trees – Binary Heaps – B-Tree – Hashing – Separate chaining – open addressing – Linear probing

UNIT IV GRAPHS 9

Definitions – Topological sort – breadth-first traversal - shortest-path algorithms – minimum spanning tree – Prim's and Kruskal's algorithms – Depth-first traversal – biconnectivity – euler circuits – applications of graphs

UNIT V ALGORITHM DESIGN AND ANALYSIS 9

Greedy algorithms – Divide and conquer – Dynamic programming – backtracking – branch and bound – Randomized algorithms – algorithm analysis – asymptotic notations – recurrences – NP-complete problems

L : 45 T:15 TOTAL : 60 PERIODS

TEXT BOOKS

1. Weiss.M.A, “Data Structures and Algorithm Analysis in C”, Pearson Education Asia, 2002.
2. ISRD Group, “Data Structures using C”, Tata McGraw-Hill Publishing Company Ltd., 2006.

REFERENCE BOOKS

1. Aho.A,.V, Hopcroft.J.E, and Ullman.J.D, “Data Structures and Algorithms”, Pearson Education, 1983.
2. Gilberg.R.F, Forouzan.B.A, “Data Structures: A Pseudocode approach with C”, Second Edition, Thomson India Edition, 2005.
3. Sara Baase and Van Gelder.A, “Computer Algorithms”, Third Edition, Pearson Education, 2000.
4. Cormen.T.H, Leiserson.C.E, Rivest.R.L, and Stein.C, "Introduction to algorithms", Second Edition, Prentice Hall of India Ltd, 2001.

10133EE307 ELECTRON DEVICES AND CIRCUITS LABORATORY L T P C

(Common to EEE, EIE & ICE) **0 0 3 2**

1. Characteristics of Semiconductor diode and Zener diode.
2. Characteristics of Transistor under common emitter, common collector and common base configurations.
3. Characteristic of FET.
4. Characteristic of UJT.
5. Characteristics of SCR, DIAC and TRIAC.
6. Photo diode, phototransistor Characteristics and study of light activated relay circuit.
7. Static characteristics of Thermistors.
8. Single phase half wave and full wave rectifiers with inductive and capacitive filters.
9. Differential ampliers using FET.
10. Study of CRO.
11. Series and Parallel reasonance circuits.
12. Realization of Passive filters.

TOTAL: 45 PERIODS

REQUIRMENT FOR A BATCH OF 30 STUDENTS

S.NO	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	Regulated Power Supply	15		
2.	Duel Tree CRO (20MHz)	15		
3.	Function Generator	15		
4.	3½ Digit Digital Multimeter	10		
5.	Bread Boards	40		
6.	Transistor	25 Nos		
7.	JFET	10 Nos		
8.	Diode	10 Nos		
9.	Zener Diode	5 Nos		
10.	UJT	5 Nos		
11	Photo Diode	5 Nos		
12.	Photo Transistor	5 Nos		
13.	Thermistors	5 Nos		
14.	OP-amp	10 Nos		
15.	Milli Ammeter (0-100mA)	15 Nos		
16	Micro Ammeter (0-50μA)	10Nos		
17.	Low range Voltmeter (0-30V)	50 Nos		
18.	Resistor of various ranges	50 Nos		
19.	Capacitors of various ranges	50 Nos		
20.	Connecting Wires	Sufficient Nos		

10133EE308 DATA STRUCTURES AND ALGORITHMS LABORATORY **L T P C 0 0 3 2**

(Common to EEE, EIE& ICE)

AIM

To develop skills in design and implementation of data structures and their applications.

1. Implement singly and doubly linked lists.
2. Represent a polynomial as a linked list and write functions for polynomial addition.
3. Implement stack and use it to convert infix to postfix expression
4. Implement array-based circular queue and use it to simulate a producer consumer problem.
5. Implement an expression tree. Produce its pre-order, in-order, and post-order traversals.
6. Implement binary search tree.
7. Implement insertion in AVL trees.
8. Implement priority queue using heaps
9. Implement hashing techniques
10. Perform topological sort on a directed graph to decide if it is acyclic.
11. Implement Dijkstra's algorithm using priority queues
12. Implement Prim's and Kruskal's algorithms
13. Implement a backtracking algorithm for Knapsack problem
14. Implement a branch and bound algorithm for traveling salesperson problem
15. Implement any randomized algorithm.

TOTAL : 45

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.NO	Description of Equipment	Quantity required	Quantity available	Deficiency %
	Hardware Required			
1.	Computer (Pentium 4)	40 Nos with One Server		
2.	Dot matrix printer	3 Nos		
3.	Laser Printer	2 Nos		
4.	UPS (5 KVA)	2		
	Software Required			
5.	Turbo C	40 Nodes		

L T P C

10133EE309 MEASUREMENTS AND INSTRUMENTATION LABORATORY **0 0 3 2**

AIM

The aim of this lab is to fortify the students with an adequate work experience in the measurement of different quantities and also the expertise in handling the instruments involved.

OBJECTIVE

To train the students in the measurement of displacement, resistance, inductance, torque and angle etc., and to give exposure to AC, DC bridges and transient measurement.

1. Study of displacement and pressure transducers
2. AC bridges.
3. DC bridges.
4. Characteristics of Temperature Transducer.
5. Hall effect Transducer.
6. Study of transients.
7. Calibration of single-phase energy meter.
8. Calibration of current transformer.
9. Measurement of three phase power and power factor.
10. Measurement of iron loss.

TOTAL : 45 PERIODS

Detailed Syllabus

1(a) Study of Displacement Transducer – LVDT

Aim

To study the operation of LVDT

Objectives

1. To study the basic principle of LVDT.
2. Study of signal conditioning circuit.
3. Study of LVDT as transducer.

Exercise

1. Draw the characteristic curve for a given LVDT.
2. Find the residual voltage.
3. Fluid the non-electrical quantity displacement interms of voltage.

Equipment

1. LVDT kit – 1 No
2. Multimeter – 1 No

1(b) Study of Pressure Transducer

Aim

To study the operation of bourdon tube

Objectives

1. To study the basic principle of Bourdon tube.
2. Study of Bourdon tube as transducer.

Exercise
1. Draw the characteristic curve for a given Bourdon tube i.e. pressure vs. o/p (V or I).
2. Measure the non-electrical quantity pressure interms of voltage or current.

Equipment
1. Bourdon pressure transducer kit – 1 No
2. Foot pump – 1 No
3. Voltmeter – 1 No
4. Multimeter – 1 No

2. AC BRIDGES

a) Maxwell's Inductance – Capacitance Bridge

Aim
To find the unknown inductance and Q factor of a given coil.

Objective
1. To find the unknown inductance of the given coil using bridge circuit.
2. To study that Maxwell inductance, capacitance bridge is suitable for the measurement of law Q coils.

Exercise
1. Design a bridge circuit for the given parameters.
2. Fluid Q factor of the coil.
3. Fluid unknown Inductance.

Equipment
1. Maxwell's inductance Capacitance Bridge kit – 1 No
2. Multimeter – 1 No
3. Unknown Inductance – 1 No

b) Schering Bridge

Aim
To measure the unknown capacitance using Schering bridge.

Objective
1. To measure the unknown capacitance.
2. To study about dissipation factor.

Exercise
1. Design a bridge circuit for the given parameters.
2. Find the dissipation factor.
3. Fluid the unknown capacitance.

Equipment
1. Schering Bridge kit – 1 No
2. Multimeter – 1 No
3. Unknown capacitance – 1 No

3. DC Bridges

a) Wheat Stone Bridge

Aim
To measure the given medium resistance using Wheatstone Bridge.

Objective
1. To study the working of bridge under balanced and unbalanced condition.
2. To study the sensitivity of bridge.

Exercise
1. Design a bridge for the given parameters.
2. Find the unknown resistance.
3. Find the sensitivity of Bridge.

Equipment
1. Wheat stone Bridge kit – 1 No
2. Unknown resistance – 1 No
3. Multimeter – 1 No

b) Kelvin's Double bridge

Aim
To measure the given low resistance using Kelvin's double bridge method.

Objective
1. To study the working of bridge under balanced and unbalance condition.
2. To study the sensitivity of bridge.

Exercise
1. Design a bridge for the given parameters.
2. Find the unknown low resistance.
3. Find the sensitivity of bridge.

Equipment
1. Kelvin Double bridge kit – 1 No
2. Unknown resistance – 1 No
3. Multimeter – 1 No

4. Characteristics of Temperature Transducer

4. (a) 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^{U}C.
3. Note down the readings for every 5^{U}C 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

4. (b) 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

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. Study of Transients

Aim

To study the transient response of the given system

Objective

1. To study the transient behaviour of the given system
2. To study the effects of transients

Exercise

1. Draw the response curve for the given system
2. Find the time when the error is minimum

Equipment
1. Resistance – 1 No
2. Capacitance – 1 No
3. RPS – 1 No
4. Voltmeter – 1 No
5. Multimeter – 1 No

7. Calibration of Single-Phase Energy Meter
Aim
To calibrate the given single phase energy meter at unity and other power factors
Objectives
1. To study the working of energy meter
2. Too accurately calibrate the meter at unity and other power factor
3. To study the % of errors for the given energy meters
Exercise
1. Measure the experimental energy consumed
2. Calculate the theoretical energy
3. Calculate the percentage of error
4. Draw the calibration curve
Equipment
1. Energy meter – 1 No
2. Wattmeter – 1 No
3. Stop watch – 1 No
4. M.I Ammeter – 1 No
5. M.I Voltmeter – 1 No

8. Calibration of Current Transformer
Aim
To study the working of current transformer
Objective
1. To study the current transformation concept
2. To study the efficiency of a given current transformer
3. To study the loss components in the circuit
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. Measurement of 3 Phase Power And Power Factor

Aim
To conduct a suitable experiment on a 3-phase load connected in star or delta to measure the three phase power and power factor using 2 wattmeter method.

Objectives

1. To study the working of wattmeter
2. To accurately measure the 3 phase power
3. To accurately measure the powerfactor
4. To study the concept of star connected load and delta connected load

Exercise

1. Measure the real power, reactive power and power factor of 3 phase resistive inductive load.
2. Measure the real power, reactive power and power factor of 3 phase resistive capacitive load.

Equipment

1. 3 phase Auto transformer – 1 No
2. M.I Ammeter – 1 No
3. M.I Voltmeter – 1 No
4. Wattmeter – 1 No

10. Measurement of Iron Loss (Maxwell Bridge)

Aim

To determine the iron losses in magnetic material using bridge method

Objective

1. To study about hysterisis loss
2. To study about eddy current loss

Exercise

1. Measure the current
2. Calculate iron loss
3. Calculate AC permeability
4. Draw phasor diagram

Equipment

1. Maxwell bridge set up – 1 No
2. Ring specimen – 1 No
3. Ammeter – 1 No
4. Galvanometer – 1 No

REQUIREMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	LVDT kit	1 No.		
2.	Multimeter	8 No.		
3.	Bourdon pressure transducer kit	1 No.		
4.	Foot pump	1 No.		
5.	Voltmeter	4 No.		
6.	Maxwell's inductance Capacitance Bridge kit	1 No.		
7.	Unknown Inductance	1 No.		
8.	Schering Bridge kit	1 No.		
9.	Unknown capacitance	1 No.		
10.	Wheat stone Bridge kit	1 No.		
11.	Unknown resistance	1 No.		
12.	Kelvin Double bridge kit	1 No.		
13.	Unknown resistance	1 No.		
14.	Operational Amplifier	1 No.		
15.	Resistors	3 No.		
16.	RPS	4 No.		
17.	IC 741	2 No.		
18.	DC trainer kit	2 No.		
19.	CRO	2 No.		
20.	Resistance	1 No.		
21.	Capacitance	1 No.		
22.	Energy meter	1 No.		
23.	Wattmeter	2 No.		
24.	Stop watch	1 No.		
25.	M.I Ammeter	2 No.		
26.	M.I Voltmeter	2 No.		
27.	Current Transformer	1 No.		
28.	Lamp Load	1 No.		
29.	Ammeter	2 No.		
30.	3 phase Auto transformer	1 No.		
31.	Maxwell bridge set up	1 No.		
32.	Ring specimen	1 No.		
33.	Galvanometer	1 No.		

		L T P C
10177MA401	**NUMERICAL METHODS**	**3 1 0 4**

(Common to Civil, Aero & EEE)

AIM

With the present development of the computer technology, it is necessary to develop efficient algorithms for solving problems in science, engineering and technology. This course gives a complete procedure for solving different kinds of problems occur in engineering numerically.

OBJECTIVES

At the end of the course, the students would be acquainted with the basic concepts in numerical methods and their uses are summarized as follows: i. The roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and eigen value problem of a matrix can be obtained numerically where analytical methods fail to give solution. ii. When huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

Solution of equation - Fixed point iteration: x=g(x) method – Newton's method – Solution of linear system by Gaussian elimination and Gauss-Jordon methods – Iterative methods - Gauss-Seidel methods - Inverse of a matrix by Gauss Jordon method – Eigen value of a matrix by power method and by Jacobi method for symmetric matrix.

UNIT II INTERPOLATION AND APPROXIMATION 9

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – BNewton's forward and backward difference formulas.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Differentiation using interpolation formulae –Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpsons's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step methods: Taylor series method – Euler methods for First order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

L : 45 T :15 TOTAL :60 PERIODS

TEXT BOOKS

1. Veerarjan,T and Ramachandran.T, “Numerical Methods with programming in C” Second Edition Tata McGraw Hill Pub.Co.Ltd, First reprint 2007.
2. Sankar Rao.K, “Numerical Methods For Scientisits and Engineers” –3rd Edition Princtice Hall of India Private, New Delhi, 2007.

REFERENCE BOOKS

1. Kandasamy.P, Thilagavathy.K and Gunavathy.K, “Numerical Methods”, S.Chand Co. Ltd., New Delhi, 2003.
2. Gerald C.F. and Wheate, P.O. “Applied Numerical Analysis”… Edition, Pearson Education Asia, New Delhi.

L T PC

10133EE402 ELECTRICAL MACHINES – I 3 1 0 4

AIM

To expose the students to the basic principles of Electro mechanical Energy Conversion in Electrical Apparatus and the operation of Transformers and DC Machines.

OBJECTIVES

i. To familiarize the constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.

ii. To introduce the principles of electromechanical energy conversion in singly and multiply excited systems.

iii. To study the working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in all Electrical Machines.

iv. To study the working principles of DC machines as Generator and Motor, types, determination of their no-load/load characteristics, starting and methods of speed control of motors.

v. To estimate the various losses taking place in D.C. machines and to study the different testing methods to arrive at their performance.

UNIT I INTRODUCTION 6

Electrical machine types – Magnetic circuits – Inductance – Statically and Dynamically induced EMF - Torque – Hysteresis- Core losses - AC operation of magnetic circuits.

UNIT II TRANSFORMERS 10

Construction – principle of operation – equivalent circuit – losses – testing – efficiency and voltage regulation – auto transformer – three phase connections – parallel operation of transformers – tap changing.

UNIT III ELECTROMECHANICAL ENERGY CONVERSION 9

Energy in magnetic systems – field energy, coenergy and mechanical force – singly and multiply excited systems.

UNIT IV BASIC CONCEPTS IN ROTATING MACHINES 9

Generated voltages in ac and dc machines, mmf of distributed windings – magnetic fields in rotating machines – rotating mmf waves – torque in ac and dc machines.

UNIT V DC MACHINES 11

Construction – EMF and torque – circuit model – armature reaction – commutation – methods of excitation – characteristics of generators – characteristics of motors – starting and speed control – testing and efficiency – parallel operation.

L :45 T :15 TOTAL: 60 PERIODS

TEXT BOOK

1. Nagrath I. J and Kothari D. P. “Electric Machines”, Tata McGraw Hill Publishing Company Ltd, 1990.
2. Bimbhra.P.S, “Electrical Machinery”, Khanna Publishers, 2003.

REFERENCE BOOKS

1. Fitzgerald.A.E., Charles Kingsely Jr, Stephen D.Umans, “Electric Machinery”, McGraw Hill Books Company, 1992.
2. Sen.P.C., “Principles of Electrical Machines and Power Electronics”, John Wiley&Sons, 1997.
3. Murugesh Kumar.K, ‘Electric Machines’, Vikas publishing house Pvt Ltd, 2002.

		L T P C
10133EE403	**POWER PLANT ENGINEERING**	**3 0 0 3**

AIM

Expose the students to basics of various power plants so that they will have the comprehensive idea of power system operation.

OBJECTIVES

To become familiar with operation of various power plants.

UNIT I THERMAL POWER PLANTS

Basic thermodynamic cycles, various components of steam power plant-layoutpulverized coal burners- Fluidized bed combustion-coal handling systems-ash handling systems- Forced draft and induced draft fans- Boilers-feed pumps-super heaterregenerator- condenser-dearearators-cooling tower

UNIT II HYDRO ELECTRIC POWER PLANTS

Layout-dams-selection of water turbines-types-pumped storage hydel plants

UNIT III NUCLEAR POWER PLANTS

Principles of nuclear energy- Fission reactions-nuclear reactor-nuclear power plants

UNIT IV GAS AND DIESEL POWER PLANTS

Types, open and closed cycle gas turbine, work output & thermal efficiency, methods to improve performance-reheating, intercoolings, regeneration-advantage and disadvantages-Diesel engine power plant-component and layout

UNIT V NON-CONVENTIONAL POWER GENERATION

Solar energy collectors, OTEC, wind power plants, tidal power plants and geothermal resources, fuel cell, MHD power generation-principle, thermoelectric power generation, thermionic power generation

TOTAL : 45 PERIODS

TEXT BOOKS

1. Arora and Domkundwar, “A Course in Power Plant Engineering”, Dhanpat Rai and Co.Pvt.Ltd., New Delhi.
2. Nag.P.K, “Power Plant Engineering” Tata McGraw Hill, Second Edition , Fourth reprint 2003.

REFERENCE BOOKS

1. G.A.Skrotzki and William A. Vopat, “Power station Engineering and Economy”Bernhardt Tata McGraw Hill Publishing Company Ltd., New Delhi, 20th reprint 2002.
2. Rai.G.D, “An introduction to power plant technology” Khanna Publishers, Delhi- 110 005.
3. Power Plant Technology, M.M. El-Wakil McGraw Hill 1984.

L T PC

10133EE404 CONTROL SYSTEMS 3 1 0 4

(Common to EEE, EIE & ICE)

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 to desire their transfer function models.

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

iii To accord basic knowledge in 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.

UNIT I 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.

UNIT II TIME RESPONSE 9

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

UNIT III FREQUENCY RESPONSE 9

Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

UNIT IV STABILITY 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.

UNIT V COMPENSATOR DESIGN 9

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

L :45 T :15 TOTAL :60 PERIODS

TEXT BOOKS

1.Nagrath.I.J and Gopal.M, “Control Systems Engineering”, New Age International Publishers, 2003.
2. Benjamin C. Kuo, “Automatic Control systems”, Pearson Education, New Delhi, 2003.

REFERENCE BOOKS

1. Ogata.K, “Modern Control Engineering”, 4th edition, PHI, New Delhi, 2002.
2. Norman S. Nise, “Control Systems Engineering”, 4th Edition, John Wiley, New Delhi, 2007.
3. Samarajit Ghosh, “Control systems”, Pearson Education, New Delhi, 2004
4. Gopal.M, “Control Systems, Principles and Design”, Tata McGraw Hill, New Delhi, 2002.

10133EE405 LINEAR INTEGRATED CIRCUITS AND APPLICATIONS **L T PC 3 0 0 3**

(Common to EEE, EIE & ICE)

AIM

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

OBJECTIVES

i. To study the IC fabrication procedure.
ii. To study characteristics; realize 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.

UNIT I IC FABRICATION 9

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

UNIT II 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.

UNIT III 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.

UNIT IV 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.

UNIT V 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.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Ramakant A.Gayakward, “Op-amps and Linear Integrated Circuits”, IV edition, Pearson Education, 2003 / PHI. (2000)
2. Roy Choudhary.D, 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

L T PC

10133EE406 DIGITAL LOGIC CIRCUITS 3 0 0 3

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.
v. To introduce digital simulation techniques for development of application oriented logic circuit.

UNIT I BOOLEAN ALGEBRA AND COMBINATIONAL CIRCUITS 9

Boolean algebra: De-Morgan's theorem, switching functions and simplification using K-maps & Quine McCluskey method, Design of adder, subtractor, comparators, code converters, encoders, decoders, multiplexers and demultiplexers.

UNIT II SYNCHRONOUS SEQUENTIAL CIRCUITS 9

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

UNIT III ASYNCHRONOUS SEQUENCTIAL CIRCUIT 9

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

UNIT IV PROGRAMMABLE LOGIC DEVICES, MEMORY AND LOGIC FAMILIES 9

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

UNIT V VHDL 9

RTL Design – combinational logic – Types – Operators – Packages – Sequential circuit – Sub programs – Test benches. (Examples: adders, counters, flipflops, FSM, Multiplexers / Demltiplexers).

TOTAL:45 PERIODS

TEXT BOOKS

1. Raj Kamal, "Digital systems-Principles and Design", Pearson education 2nd edition, 2007
2. Morris Mano.M "Digital Design", Pearson Education, 2006.
3. 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 and Jain, "Digital Fundamentals", 8th edition, Pearson Education, 2003.
3.John F.Wakerly, "Digital Design Principles and Practice", 3rd edition, Pearson Education, 2002.
4. Tocci, "Digital Systems : Principles and aopplications", 8th Edition Pearson Education.

L T PC

10133EE407 CONTROL SYSTEM LABORATORY 0 0 3 2

1. Determination of transfer function of DC Servomotor
2. Determination of transfer function of AC Servomotor.
3. Analog simulation of Type - 0 and Type – 1 systems
4. Determination of transfer function of DC Generator
5. Determination of transfer function of DC Motor
6. Stability analysis of linear systems
7. DC and AC position control systems
8. Stepper motor control system
9. Digital simulation of first systems
10. Digital simulation of second systems

TOTAL:45 PERIODS

Detailed Syllabus

1. Determination of Transfer Function Parameters of a DC Servo Motor
Aim
To derive the transfer function of the given D.C Servomotor and experimentally determine the transfer function parameters

Exercise
1. Derive the transfer function from basic principles for a separately excited DC motor.
2. Determine the armature and field parameters by conducting suitable experiments.
3. Determine the mechanical parameter by conducting suitable experiments.
4. Plot the frequency response. Equipment
1. DC servo motor : field separately excited – loading facility – variable voltage source - 1 No
2. Tachometer : 1 No
3. Multimeter : 2 Nos
4. Stop watch : 1 No

2. Determination of Transfer Function Parameters of AC Servo Motor
Aim
To derive the transfer function of the given A.C Servo Motor and experimentally determine the transfer function parameters

Exercise
1. Derive the transfer function of the AC Servo Motor from basic Principles.
2. Obtain the D.C gain by operating at rated speed.
3. Determine the time constant (mechanical)
4. Plot the frequency response Equipment
1. AC Servo Motor : Minimum of 100w – necessary
sources for main winding and control winding – 1 No
2. Tachometer : 1 No

3. Analog Simulation Of Type-0 And Type-1 System
Aim
To simulate the time response characteristics of I order and II order, type 0 and type-1 systems.

Exercise

1. Obtain the time response characteristics of type – 0 and type-1, I order and II order systems mathematically.
2. Simulate practically the time response characteristics using analog rigged up modules.
3. Identify the real time system with similar characteristics.

Equipment

1. Rigged up models of type-0 and type-1 system using analog components.
2. Variable frequency square wave generator and a normal CRO - 1 No

(or)

DC source and storage Oscilloscope - 1 No

4. Determination of Transfer function of DC Generator

Aim

To determine the transfer function of DC generator

Exercise

1. Obtain the transfer function of DC generator by calculating □ and gain

Equipment

1. DC Generator
2. Tachometer
3. Various meters
4. Stop watch

5. Determination of Transfer function of DC Motor

Aim

To determine the transfer function of DC motor

Exercise

1. Obtain the transfer function of DC motor by calculating □ and gain

Equipment

1. DC Motor
2. Tachometer
3. Various meters
4. Stop watch

6. Stability Analysis of Linear Systems

Aim

To analyse the stability of linear systems using Bode / Root locus / Nyquist plot

Exercise

1. Write a program to obtain the Bode plot / Root locus / Nyquist plot for the given system
2. Access the stability of the given system using the plots obtained
3. Compare the usage of various plots in assessing stability

Equipment

1. System with MATLAB / MATHCAD / equivalent software - 3 user license

7. DC and AC position Control system

Aim

To study the AC and DC position control system and draw the error characteristics between setpoint and error.

Exercise

1. To study various positions and calculate the error between setpoint and output. position

2. To measure outputs at various points (between stages)

Equipment

1. AC and DC position control kit with DC servo motor.
2. Power transistor
3. Adder

8. Stepper Motor Control System

Aim

To study the working of stepper motor

Exercise

1. To verify the working of the stepper motor rotation using microprocessor.

Equipment

1. Stepping motor
2. Microprocessor kit
3. Interfacing card
4. Power supply

9. Digital Simulation of First order System

Aim

To digitally simulate the time response characteristics of first -order system

Exercise

1. Write a program or build the block diagram model using the given software.
2. Obtain the impulse, step and sinusoidal response characteristics.
3. Identify real time systems with similar characteristics.

Equipment

1. System with MATLAB / MATHCAD (or) equivalent software - minimum 3 user license.

10. Digital Simulation of Second order Systems

Aim

To digitally simulate the time response characteristics of second -order system

Exercise

1. Write a program or build the block diagram model using the given software.
2. Obtain the impulse, step and sinusoidal response characteristics.
3. Identify real time systems with similar characteristics.

Equipment

System with MATLAB / MATHCAD (or) equivalent software - minimum 3 userlicense.

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	DC servo motor Tachometer Multimeter Stop watch	field separately excited – loading facility – variable voltage source - 1 No 1 No 2 Nos 1 No		
2.	AC Servo Motor Tachometer Stopwatch Voltmeter	Minimum of 100w – necessary sources for main winding and control winding – 1 No 1 No 1 No 1 No		
3.	Rigged up models of type-0 and type-1 system using analog components Variable frequency square wave generator and a normal CRO (Or) DC source and storage Oscilloscope	- 1 No		
4.	DC Generator Tachometer Various meters Stop watch			
5.	DC Motor Tachometer Various meters Stop watch			
6.	System with MATLAB / MATHCAD (or) equivalent software	minimum 3 user license		
7.	AC and DC position control kit with DC servo motor Power transistor			

S.No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
	Adder			
8.	Stepping Motor Microprocessor kit Interfacing card Power supply			
9.	System with MATLAB / MATHCAD (or) other equivalent software	minimum 3 user license		
10.	System with MATLAB / MATHCAD / equivalent software	Minimum 3 user license		

10133EE408 LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY **L T P C 0 0 3 2**

(Common to EEE, EIE & ICE)

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 Gray 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:

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.

TOTAL: 45 PERIODS

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

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

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

[Minimizations 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 genertor and parity checking, Excess 3, 2s Complement,
Binary to grey code using suitable ICs .
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 ICs.
Exercise
1. Decimal to binary Conversion using dedicated ICs.
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 Demultiplex 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.

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.NO	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	Interface such as,A/D,D/A converter DMA, PIC Serial, Interface, Temperatures controller, Stepper Motor, Key board	4 each		
2.	CRO and function generator	3 each		
3.	IC trainer Kit	15		
4.	Analog AC trainer kit	4		
5.	Components and bread boards	10 each		
6.	Chips IC -7400	10		
7.	Chips IC-7402	10		
8.	Chips IC -7408	10		
9.	Chips IC -7432	10		
10.	Chips IC -7410	25		
11.	Chips IC -555	10		
12.	Chips IC -741	10		
13.	Chips IC -74153	10		
14.	Chips IC -7474	10		
15.	Chips IC -7490	10		
16.	Chips IC -7447	10		
17.	Chips IC -7476	10		
18.	Chips IC -7420	10		
19.	Chips IC -7404	15		
20.	Chips LM -317	10		
21.	Chips LM -723	10		
22.	Chips MA -7840	10		
23.	Chips LM -380	10		
24.	Chips ICL-8038	10		
25.	Traffic light control kit	2		
26.	VDU	2		
27.	7 segment Display	5		
28.	Interfacing card such as keyboard etc.	3 each		
29.	Work tables	15		

L T P C

10133EE409 ELECTRICAL MACHINES LABORATORY – I 0 0 3 2

AIM

To expose the students to the operation of D.C. machines and transformers and give them experimental skill.

1. Open circuit and load characteristics of separately and self excited DC shunt Generators.
2. Load characteristics of DC compound generator with differential and cumulative connection.
3. Load characteristics of DC shunt and compound motor.
4. Load characteristics of DC series motor.
5. Swinburne's test and speed control of DC shunt motor.
6. Hopkinson's test on DC motor – generator set.
7. Load test on single-phase transformer and three phase transformer connections.
8. Open circuit and short circuit tests on single phase transformer.
9. Sumpner's test on transformers.
10. Separation of no-load losses in single phase transformer.

TOTAL: 45 PERIODS

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.NO	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	D.C motor – Generator set D.C motor –Shunt Generator D.C motor –compound Generator	 2 set 2 set		
2.	D.C. Shunt Motor	2 Nos		
3.	D.C. Series Motor	1 No		
4.	D.C. Compound Motor	1 No		
5.	Single phase transformers	7 Nos		
6.	Three phase transformers	2 Nos		
7.	D.C. Motor –Alternator set	4 sets		
8.	Three phase Induction Motor(Squirrel cage)	3 Nos		
9.	Three phase slip ring Induction Motor	1 No		
10.	Single phase Induction Motor	2 Nos		
11.	Resistive load 3 phase -2. Single phase -3	5 Nos		
12.	Inductive load	1 No		
13.	Single phase Auto transformer	5 Nos		
14.	Three phase Auto transformer	3 Nos		
15.	Moving Coll Ammeter of different ranges	20 Nos		
16.	Moving Coll Voltmeter of different ranges	20 Nos		
17.	Moving Iron Ammeter of different ranges	20 Nos		
18.	Moving Iron Voltmeter of different ranges	20 Nos		
19.	Wire Wound Rheostats of different ratings	30 Nos		
20.	Tachometers	10 Nos		
21.	Single element wattmeters of different ranges UPF /LPF	20 Nos		
22.	Double element wattmeters of different ranges	4 Nos		
23.	Power factor meter	2 Nos		
24.	Digital multimeter	5 Nos		
25.	Three point starter, four point starter, DOL starter, manual star /delta starter, semi automatic and fully automatic star / delta starter	1 No each For study experiment		

L T P C

10144EE501 COMMUNICATION ENGINEERING 3 0 0 3

AIM

To introduce the concepts of communication systems engineering using wire and wireless medium

OBJECTIVES

To introduce different methods of analog communication and their significance
To introduce Digital Communication methods for high bit rate transmission
To introduce the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission.
To introduce MAC used in communication systems for enhancing the number of users.
To introduce various media for digital communication

UNIT I ANALOG COMMUNICATION 9

AM – Frequency spectrum – vector representation – power relations – generation of AM – DSB, DSB/SC, SSB, VSB AM Transmitter & Receiver; FM and PM – frequency spectrum – power relations : NBFM & WBFM, Generation of FM and DM, Amstrong method & Reactance modulations : FM & PM frequency.

UNIT II DIGITAL COMMUNICATION 9

Pulse modulations – concepts of sampling and sampling theormes, PAM, PWM, PPM, PTM, quantization and coding : DCM, DM, slope overload error. ADM, DPCM, OOK systems – ASK, FSK, PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication.

UNIT III SOURCE CODES, LINE CODES & ERROR CONTROL (Qualitative only) 9

Primary communication – entropy, properties, BSC, BEC, source coding : Shaum, Fao, Huffman coding : noiseless coding theorum, BW – SNR trade off codes: NRZ, RZ, AMI, HDBP, ABQ, MBnB codes : Efficiency of transmissions, error control codes and applications: convolutions & block codes.

UNIT IV MULTIPLE ACCESS TECHNIQUES 9

SS&MA techniques: FDMA, TDMA, CDMA, SDMA application in wire and wireless communication: Advantages (merits) :

UNIT V SATELLITE, OPTICAL FIBER – POWERLINE, SCADA 9

Orbits: types of satellites: frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite – Intelsat and Insat: fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications: SCADA

TOTAL : 45 PERIODS

TEXT BOOKS

1.Taub & Schiling “Principles of communication systems” Tata McGraw hill 2007
2. Das J. “Principles of Digital communication” New Age International, 1986

REFERENCE BOOKS

1. Kennedy and Davis “Electronic communication systems” Tata McGraw hill, 4th edition, 1993.
2. Sklar “Digital communication fundamentals and applications“ Pearson Education, 2001
3. Bary le, Memuschmidt, “Digital Communication”, Kluwer Publication, 2004.
4. Lathi B.P. “Modern digital and analog communication systems” Oxford University Press, 1998.

L T P C

10144EC502 DIGITAL SIGNAL PROCESSING 3 1 0 4

AIM

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

OBJECTIVES

To classify signals and systems & their mathematical representation. To analyse the discrete time systems.
To study various transformation techniques & their computation.
To study about filters and their design for digital implementation.
To study about a programmable digital signal processor & quantization effects.

UNIT I 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.

UNIT II 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.

UNIT III 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.

UNIT IV 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.

UNIT V DIGITAL SIGNAL PROCESSORS 9

Introduction – Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial Processors

L:45 T:15 TOTAL : 60 PERIODS

TEXT BOOKS

1. Proakis J.G. and Manolakis, D.G. 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, 2003 / PHI.
2. Mitra, S.K. '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. Emmanuel C Ifeachor and Barrie W Jervis ,"Digital Signal Processing – A Practical approach" Pearson Education, Second edition, 2002.
3. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", Second Edition, California Technical Publishing San Diego, California. w.DSPguide.com)
4Venkataramani, . B. Bhaskar M., 'Digital Signal Processors, Architecture, Programming and Applications', Tata McGraw Hill, New Delhi, 2003.

L T P C

10133EC506 MICROPROCESSORS AND MICRO CONTROLLER 3 0 0 3

AIM

To introduce Microprocessor Intel 8085 and 8086 and the Micro Controller 8051

OBJECTIVES

To study the Architecture of 8085 & 8086, 8051
To study the addressing modes & instruction set of 8085 & 8051.
To introduce the need & use of Interrupt structure 8085 & 8051.
To develop skill in simple program writing for 8051 & 8085 and applications
To introduce commonly used peripheral / interfacing ICs

UNIT I 8085 and 8086 PROCESSOR 9

Hardware Architecture pintouts - Signals – Memory interfacing – I/O ports and data transfer concepts – Timing Diagram – Interrupt structure.

UNIT II PROGRAMMING OF 8085 PROCESSOR 9

Instruction format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing - Look up table - Subroutine instructions - stack.

UNIT III 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.

UNIT IV 8051 MICRO CONTROLLER 9

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

UNIT V 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 - Washing Machine Control.

TOTAL : 45 PERIODS

TEXT BOOKS

1.Saravanan.M, Senthil Kumar.N.Jeevanantha.S, " Microprocessor and Microcontroller", Oxford University Press,2010.
2. Krishna Kant,"Microprocessor and Microcontrollers", Eastern Company Edition, Prentice – Hall of India, New Delhi , 2007.
3. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely, "The 8051 Micro Controller and Embedded Systems", PHI Pearson Education, 5th Indian reprint, 2003.

REFERENCE BOOKS

1. Gaonkar, R.S. "Microprocessor Architecture Programming and Application", Wiley Eastern Ltd., New Delhi.
2. Walter A Tribal & Avtar Singh, "The 8088 & 8086 Microprocessors" , Pearson, 2007, Fourth Edition.
3.Thiagarajan.R, "A Textbook of Microprocessors and Microcontroller", Scitech Publication, 2010.

		L T P C
10144EE504	**POWER ELECTRONICS**	**3 0 0 3**

AIM

Learning how to apply the electronic devices for conversion, control and conditioning of electronic power.

OBJECTIVES

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

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

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

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

To study the operation of AC voltage controller and Matrix converters.

To study simple applications

UNIT I POWER SEMI-CONDUCTOR DEVICES 9

Study of switching devices, - Frame, Driver and snubber circuit of SCR, TRIAC, BJT, IGBT, MOSFET,- Turn-on and turn-off characteristics, switching losses, Commutation circuits for SCR.

UNIT II PHASE-CONTROLLED CONVERTERS 9

2-pulse, 3-pulse and 6-pulse converters – Effect of source inductance – performance parameters – Reactive power control of cnverters – Dual converters - Battery charger.

UNIT III DC TO DC CONVERTER 9

Step-down and step-up chopper - Time ratio control and current limit control – Buck, boost, buck-boost converter, concept of Resonant switching - SMPS.

UNIT IV INVERTERS 9

Single phase and three phase (both 1200 mode and 1800 mode) inverters – PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulations - Voltage and harmonic control - Series resonant inverter - Current source inverter.

UNIT V AC TO AC CONVERTERS 9

Single phase AC voltage controllers – Multistage sequence control - single and three phase cycloconverters –Introduction to Integral cycle control, Power factor control and Matrix converters.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Rashid.M.H, “Power Electronics: Circuits, Devices and Applications”, Pearson Education, PHI Third edition, New Delhi 2004.
2. Philip T.Krein, “Elements of Power Electronics”, Oxford University Press, 2004 Edition.

REFERENCES BOOKS

1. Ashfaq Ahmed,“Power Electronics for Technology”, Pearson Education, Indian reprint, 2003.
2. Bimbra.P.S ,“Power Electronics”, Khanna Publishers, third Edition 2003.
3. Ned Mohan, Tore.M.Undeland, William.P.Robbins, “Power Electronics: Converters, Applications and Design”, John Wiley and sons, third edition, 2003.

L T P C

10133EE505 ELECTRICAL MACHINES - II 3 1 0 4

AIM

To expose the students to the concepts of synchronous and asynchronous machines and analyze their performance.

OBJECTIVES

To impart knowledge on

Construction and performance of salient and non – salient type synchronous generators.

Principle of operation and performance of synchronous motor.

Construction, principle of operation and performance of induction machines.

Starting and speed control of three-phase induction motors.

Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I SYNCHRONOUS GENERATOR 9

Constructional details – Types of rotors – emf equation – Synchronous reactance – Armature reaction – Voltage regulation – EMF, MMF, ZPF and A.S.A methods – Synchronizing and parallel operation – Synchronizing torque - Change of excitation and mechanical input – Two reaction theory – Determination of direct and quadrature axis synchronous reactance using slip test – Operating characteristics - Capability curves.

UNIT II SYNCHRONOUS MOTOR 8

Principle of operation – Torque equation – Operation on infinite bus bars - V-curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed.

UNIT III THREE PHASE INDUCTION MOTOR 12

Constructional details – Types of rotors – Principle of operation – Slip – Equivalent circuit – Slip-torque characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of no load losses – Double cage rotors – Induction generator – Synchronous induction motor.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 7

Need for starting – Types of starters – Rotor resistance, Autotransformer and Star-delta starters – Speed control – Change of voltage, torque, number of poles and slip – Cascaded connection – Slip power recovery scheme.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 9

Constructional details of single phase induction motor – Double revolving field theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors - Shaded pole induction motor - Linear reluctance motor - Repulsion motor - Hysteresis motor - AC series motor.

L:45 T:15 TOTAL : 60 PERIODS

TEXT BOOKS

1. Kothari.D.P and Nagrath.I.J, “Electric Machines”, Tata McGraw Hill Publishing Company Ltd, 2002.

2. Bhimbhra.P.S, “Electrical Machinery”, Khanna Publishers, 2003.

REFERENCE BOOKS

1. Fitzgerald.A.E, Charles Kingsley, Stephen.D.Umans, “Electric Machinery”, Tata McGraw Hill publishing Company Ltd, 2003.
2. Gupta.J.B, “Theory and Performance of Electrical Machines”, S.K.Kataria and Sons, 2002.
3. Murugesh Kumar.K, “Electric Machines”, Vikas Publishing House Pvt Ltd, 2002.

L T PC

10133EE506 TRANSMISSION AND DISTRIBUTION 3 1 0 4

AIM

To understand the importance and the functioning of transmission and distribution of the electric power in an electrical utility (or) a power system.

OBJECTIVES

i. To develop expressions for the computation of transmission line parameters.
ii. To obtain the equivalent circuits for the transmission lines based on distance and operating voltage for determining voltage regulation and efficiency. Also to improve the voltage profile of the transmission system.
iii. To analyses the voltage distribution in insulator strings and cables and methods to improve the same.
iv. To understand the operation of the different distribution schemes.

UNIT I INTRODUCTION 9

Structure of electric power system - different operating voltages of generation, transmission and distribution-advantage of higher operating voltage for AC transmission. An introduction to EHV AC transmission, HVDC transmission and FACTs. Mechanical design of transmission line between towers – sag and tension calculations using approximate equations taking into account the effect of ice and wind.

UNIT II TRANSMISSION LINE PARAMETERS 9

Parameters of resistance, inductance and capacitance calculations - single and three phase transmission lines - single and double circuits - solid, stranded and bundled conductors - symmetrical and unsymmetrical spacing – transposition of lines – concepts of GMR and GMD - skin and proximity effects - interference with neighbouring communication circuits. Corona discharge characteristics – critical voltage and loss.
(Simple diagrams of typical towers and conductors for 400, 220 and 110 kV operations)

UNIT III MODELLING AND PERFORMANCE OF TRANSMISSION LINES 9

Transmission line classification - short line, medium line and long line – equivalent circuits – Ferranti effect - surge impedance, attenuation constant and phase constant - voltage regulation and transmission efficiency - real and reactive power flow in lines – power circle diagrams – shunt and series compensation. An introduction to power angle diagram - surge-impedance loading, loadability limits based on thermal loading; angle and voltage stability considerations.

UNIT IV INSULATORS AND CABLES 9

Classification of insulators for transmission and distribution purpose – voltage distribution in insulator string and grading - improvement of string efficiency. Underground cables - constructional features of LT and HT cables – insulation resistance, capacitance, dielectric stress and grading – tan δ and power loss – thermal characteristics.

UNIT V SUBSTATION, GROUNDING SYSTEM AND DISTRIBUTION SYSTEM 9

Classification, functions and major components of substations. Bus-bar arrangements - substation bus schemes - single bus, double bus with double breaker, double bus with single breaker, main and transfer bus, ring bus, breaker-and-ahalf with two main buses, double bus-bar with bypass isolators. Importance of earthing in a substation. Qualitative treatment to neutral grounding and earthing practises in substations. Feeders, distributors and service mains. DC distributor – 2-wire and 3-wire, radial and ring main distribution. AC distribution– single phase and three phase 4-wire distribution. .

L:45 T:15 TOTAL :60 PERIODS

TEXT BOOKS

1. Gupta B.R., "Power System Analysis and Design", S. Chand, New Delhi, 2003.
2.Singh. S.N., "Electric Power Generation, Transmission and Distribution", Prentice Hall of India Pvt. Ltd, New Delhi, 2002.

REFERENCE BOOKS

1. Luces M. Fualkenberry, Walter Coffer, "Electrical Power Distribution and Transmission", Pearson Education, 1996.
2. Hadi Saadat, "Power System Analysis", Tata McGraw Hill Publishing Company, 2003.
3. Central Electricity Authority (CEA), "Guidelines for Transmission System Planning", New Delhi.
4. "Tamil Nadu Electricity Board Handbook", 2003.

10133EE507 MICROPROCESSOR AND MICRO CONTROLLER LABORATORY **L T P C**
0 0 3 2

AIM

To understand programming using instruction sets of processors.
To study various digital & linear

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. A/D Interfacing.
4. D/A Interfacing.
5. Traffic light controller Interfacing
6. Steeper Motor Interfacing
7. Simple experiments using 8251, 8279, 8254.

16-bit Microprocessor

8. Simple arithmetic operations: Multi Precision addition / substraction/ multiplication / division.

8-bit Microcontroller

9. Demonstration of basic instructions with 8051 Micro controller execution, including:
a. Conditional jumps, looping
b. Calling subroutines.
c. Stack parameter testing
10. Interfacing Keyboard and Display
11. Steepter motor Interfacing\
a. D/A Interfacing
b. Traffic light controller Interfacing
c. 8051 based Serial Port Communication.

TOTAL : 45 PERIODS

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.NO	Description of Equipment	IC Number/code	Quantity required
1.	8085 Microprocessor Trainer with Power Supply	-	15
2.	8051 Micro controller Trainer Kit with Power Supply	-	15
3.	8086 Microprocessor Trainer Kit	-	10
4.	8255 Interface board	-	5
5.	8251 Interface board	-	5
6.	8259 Interface board	-	5
7.	8279 Keyboard/Display/Interface board	-	5
8.	8254 timer counter	-	5
9.	ADC and DAC card	-	5
10.	Stepper motor with Controller	-	5
11.	Traffic Light Control System	-	5
12.	Regulated power supply	-	10
13.	Universal ADD-ON models	-	5
14.	8 Digit Multiplexed Display Card	-	5
15.	Multimeter	-	5
16.	CRO	-	2

		L T PC
10177GE002	**COMMUNICATION SKILLS LABORATORY**	**0 0 4 2**

(Fifth / Sixth Semester)

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

Globalisation has brought in numerous opportunities for the teeming millions, with more focus on the students' overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the industry environment, thus rendering them as prospective assets to industries. The course will equip the students with the necessary communication skills that would go a long way in helping them in their profession.

OBJECTIVES:

To equip students of engineering and technology with effective speaking and listening skills in English.

To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.

To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises

I.PC based session	(Weightage 40%)	24 periods

A.English Language Lab

1. Listening Comprehension: (6)

Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.

2. Reading Comprehension: (6)

Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

Phonetics: Intonation – Ear training - Correct Pronunciation – Sound recognition exercises – Common Errors in English. Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

B. Viewing and discussing audio-visual materials (6 periods)

(Samples are available to learn and practice)

1. Resume / Report Preparation / Letter Writing (1)

Structuring the resume / report - Letter writing / Email Communication - Samples.

2. Presentation skills: (1)

Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples

3. Soft Skills: (2)

Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples

4. Group Discussion: (1)

Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs –

Strategies in GD – Team work - Body Language - Mock GD -Video samples

5. Interview Skills: **(**1)

Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews- Video samples.

II.Practice Session	(Weightage 60%)	24 periods

1. Resume / Report Preparation / Letter writing: Students prepare their own resume and report. (2)

2. Presentation Skills: Students make presentations on given topics. (8)

3. Group Discussion: Students participate in group discussions. (6)

4. Interview Skills: Students participate in Mock Interviews (8)

REFERENCES:

1. Anderson, P.V, "Technical Communication", Thomson Wadsworth , Sixth Edition, New Delhi, 2007.
2. Prakash, P, "Verbal and Non-Verbal Reasoning", Macmillan India Ltd., Second Edition, New Delhi, 2004.
3. John Seely, "The Oxford Guide to Writing and Speaking", Oxford University Press, New Delhi, 2004.
4. Evans, D, "Decisionmaker", Cambridge University Press, 1997.
5. Thorpe, E, and Thorpe, S, "Objective English", Pearson Education, Second Edition, New Delhi, 2007.
6. Turton, N.D and Heaton, J.B, "Dictionary of Common Errors", Addision Wesley Longman Ltd., Indian reprint 1998.

Lab Requirements:

1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software

S.NO	Description of Equipment	Quantity required
1.	**Server**	1 No.
	• PIV System	
	• 1 GB RAM /40 GB HDD	
	• OS: Win 2000 Server	
	• Audio card with headphones o (with mike)	
	• JRE 1.3	
2.	Client Systems	60 No
	• **PIII or above**	
	• **256 or 512 MB RAM / 40 GB** • **HDD**	
	• **OS: Win 2000**	
	• Audio card with headphones • (with mike)	
	• JRE 1.3	
3.	**Handicam Video Camera (with video lights and mic input)**	1 No
4.	Television -29	1 No
5.	Collar mike	1 No
6.	Cordless mikes	1 No
7.	Audio Mixer	1 No
8.	DVD Recorder /Player	1 No
9.	LCD Projector with MP3 /CD /DVD Provision for audio /video faculty- **Desirable**	1 No

L T P C

10133EE509 ELECTRICAL MACHINES II LABORATORY 0 0 3 2

AIM

To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

1. Regulation of three phase alternator by emf and mmf methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor test on three-phase induction motor.
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.

TOTAL : 45 PERIODS

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.NO	Description of Equipment	Quantity required
1.	DC Shunt motor coupled three phase alternator	2
2.	Synchronous motor coupled to DC motor	1
3.	Three phase induction motors- Squirrel cage Slip ring	 2 1
4.	DC Shunt motor coupled salient pole three phase alternator	1
5.	Single phase induction motors	2
6.	Inductive board	1
7.	Starter- Three phase induction motor starters Single phase induction motor starters	 1 1
8.	Meters- Voltmeter (AC) Ammeter (AC) Wattmeter (Ipf) Wattmeter (upf)	 15 15 15 30
9.	Single phase auto transformer	2
10.	Three phase auto transformer	4
11.	Rheostats of Various range	30
12.	DC panel boards (220V, 36V)	1 each
13.	AC panel board	1
14.	Work tables	12

		L T P C
10133EE601	**POWER SYSTEM ANALYSIS**	**3 1 0 4**

AIM

To understand the necessity and to become familiar with the modelling of power system and components. And to apply different methods to analyse power system for the purpose of system planning and operation.

OBJECTIVES

To model the power system under steady state operating condition. To apply efficient numerical methods to solve the power flow problem.
To model and analyse the power systems under abnormal (or) fault conditions.
To model and analyse the transient behaviour of power system when it is subjected to a fault.

UNIT I INTRODUCTION 9

Modern power system (or) electric energy system - Analysis for system planning and operational studies – basic components of a power system. Generator models - transformer model – transmission system model - load representation. Single line diagram – per phase and per unit representation – change of base. Simple building algorithms for the formation of Y-Bus matrix and Z-Bus matrix.

UNIT II POWER FLOW ANALYSIS 9

Importance of power flow analysis in planning and operation of power systems. Statement of power flow problem - classification of buses into P-Q buses, P-V (voltagecontrolled) buses and slack bus. Development of Power flow model in complex variables form and polar variables form. Iterative solution using Gauss-Seidel method including Q-limit check for voltagecontrolled
buses – algorithm and flow chart. Iterative solution using Newton-Raphson (N-R) method (polar form) including Q-limit check and bus switching for voltage-controlled buses - Jacobian matrix elements – algorithm and flow chart. Development of Fast Decoupled Power Flow (FDPF) model and iterative solution – algorithm and flowchart; Comparison of the three methods.

UNIT III FAULT ANALYSIS – BALANCED FAULTS 9

Importance short circuit (or) for fault analysis - basic assumptions in fault analysis of power systems. Symmetrical (or) balanced three phase faults – problem formulation – fault analysis using Z-bus matrix – algorithm and flow chart. Computations of short circuit capacity, post fault voltage and currents.

UNIT IV FAULT ANALYSIS – UNBALANCED FAULTS 9

Introduction to symmetrical components – sequence impedances – sequence networks – representation of single line to ground, line to line and double line to ground fault conditions. Unbalanced fault analysis - problem formulation – analysis using Z-bus impedance matrix – (algorithm and flow chart.).

UNIT V STABILITY ANALYSIS 9

Importance of stability analysis in power system planning and operation - classification of power system stability - angle and voltage stability – simple treatment of angle stability into small-signal and large-signal (transient) stability Single Machine Infinite Bus (SMIB) system:

Development of swing equation - equal area criterion - determination of critical clearing angle and time by using modified Euler method and Runge-Kutta second order method. Algorithm and flow chart.

L:45 T:15 TOTAL :60 PERIODS

TEXT BOOKS

1. Hadi Saadat, “Power System Analysis”, Tata McGraw Hill Publishing Company, New Delhi, 2002.
2. Olle. I. Elgerd, “Electric Energy Systems Theory – An Introductio”, Tata McGraw Hill Publishing Company Limited, New Delhi, Second Edition, 2003.

REFERENCE BOOKS

1. Kundur P., “Power System Stability and Control”, Tata McGraw Hill, Publications, 1994.
1. John J. Grainger and W.D. Stevenson Jr., “Power System Analysis”, McGraw Hill International Book Company, 1994.
3. Nagrath I.J. and Kothari D.P., “Modern Power System Analysis”, Tata McGraw-Hill Publishing Company, New Delhi, 1990.
4. Nagasarkar K.and Sukhija M.S, “Power System Analysis”,Oxford University Press, 2007.

		L T P C
10133EE602	**SOLID STATE DRIVES**	**3 0 0 3**

AIM

To study and understand the operation of electric drives controlled from a power electronic converter and to introduce the design concepts of controllers.

OBJECTIVES

To understand the stable steady-state operation and transient dynamics of a motorload system.

To study and analyze the operation of the converter / chopper fed dc drive and to solve simple problems.

To study and understand the operation of both classical and modern induction motor drives.

To understand the differences between synchronous motor drive and induction motor drive and to learn the basics of permanent magnet synchronous motor drives.

To analyze and design the current and speed controllers for a closed loop solid-state DC motor drive and simulation using a software package

UNIT I DRIVE CHARACTERISTICS 9

Equations governing motor load dynamics - steady state stability - Multi quadrant dynamics - Acceleration, deceleration, starting and stopping - load torque characteristics of various drives.

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE 9

Steady state analysis of the single and three phase fully controlled converter fed separately excited D.C motor drive - Continuous and discontinuous conduction Time ratio and current limit control - 4 quadrant operation of converter.

UNIT III DESIGN OF CONTROLLERS FOR DRIVES 9

Transfer function for DC motor, load and converter – Closed loop control with current and speed feedback - Armature voltage control and field weakening mode control, Design of controllers: Current controller and speed controller - Converter selection and characteristics - Use of simulation software package.

UNIT IV INDUCTION MOTOR DRIVES 9

Stator voltage control – energy efficient drive - v/f control, constant air-gap flux – field weakening mode - voltage/current fed inverters - Block diagram of vector control - closed loop control.

UNIT V SYNCHRONOUS MOTOR DRIVES 9

V/f control and self-control of synchronous motor – Marginal angle control and power factor control - Permanent magnet synchronous motor Black diagram of closed loop control.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Gopal K.Dubey, “Power Semi conductor controlled drives” ,Prentice Hall Inc., New Jersey 1989.
2. Bimal K. Bose. “Modern Power Electronics and AC Drives”, PHI / Pearson Education, 2002.

REFERENCE BOOKS

1.De.N.K and Sen.S.K, “Electrical Drives” ,PHI, 2006 9th print.
2.Murphy J.M.D. and Turnbull, “ Thyristor control of AC Motor” , Pergamon Press Oxford 1988.
3.Krishnan.R. “Electric Motor & Drives Modeling, Analysis and Control”, Prentice Hall of India, 2001.

L T PC

10133EE603 HIGH VOLTAGE ENGINEERING 3 0 0 3

AIM

To expose the students to various types of over voltage transients in power system and its effect on power system.

- Generation of over voltages in laboratory.
- Testing of power apparatus and system.

OBJECTIVES

To understand the various types of over voltages in power system and protection methods.
Generation of over voltages in laboratories.
Measurement of over voltages.
Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
Testing of power apparatus and insulation coordination.

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 6

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages – protection against over voltages – Bewley's lattice diagram.

UNIT II ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS 10

Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids – Breakdown mechanisms in solid and composite dielectrics.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 10

Generation of High DC, AC, impulse voltages and currents. Tripping and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 10

Measurement of High voltages and High currents – Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9

High voltage testing of electrical power apparatus – Power frequency, impulse voltage and DC testing – International and Indian standards – Insulation Coordination.

TOTAL : 45 PERIODS

TEXT BOOK

1. Naidu M. S. and Kamaraju, V. "High Voltage Engineering", Tata McGraw Hill, 3rd Edition, 2004.
2. Kuffel E. and Abdullah M., "High Voltage Engineering", Pergamon Press, Oxford, 1970.

REFERENCE BOOKS

1. Kuffel E. and. Zaengel, W. S "High Voltage Engineering Fundamentals", Pergamon Press, Oxford, London, 1986.
2. Alston, L. L., " High Voltage Technology",Oxford University Press, New Delhi, First Indian Edition, 2006.

		L T P C
10144CS304	**OBJECT ORIENTED PROGRAMMING**	**3 0 0 3**

AIM

To understand the concepts of object-oriented programming and master OOP using C++ and Java.

UNIT I **7**

Object oriented programming concepts – objects-classes- methods and messages abstraction and encapsulation-inheritance- abstract classes- polymorphism.Introduction to C++- objects-classes-constructors and destructors

UNIT II **12**

Operator overloading - friend functions- type conversions- templates - Inheritance – virtual functions- runtime polymorphism.

UNIT III **8**

Exception handling - Streams and formatted I/O – file handling – namespaces – String Objects - standard template library.

UNIT IV **8**

Introduction to JAVA , bytecode, virtual machines – objects – classes – Javadoc – packages – Arrays – Strings

UNIT V **10**

Inheritance – interfaces and inner classes - exception handling – threads - Streams and I/O

TOTAL : 45 PERIODS

TEXT BOOKS

1. Trivedi.B, “Programming with ANSI C++”, Oxford University Press, 2007.
2. Cay S. Horstmann, Gary Cornell, “Core JAVA volume 1”, Eighth Edition, Pearson Education, 2008.

REFERENCE BOOKS

1. ISRD Group, “Introduction to Object-oriented Programming and C++”, Tata McGraw-Hill Publishing Company Ltd., 2007.
2. ISRD Group, “Introduction to Object-oriented programming through Java”, Tata McGraw-Hill Publishing Company Ltd., 2007.
3. Lippman, Josee Lajoie, S. B. Barbara E. Moo, “C++ Premier”, Fourth Edition, Pearson Education, 2005.
4. Malik, D. S. “C++ Programming: From Problem Analysis to Program Design”, Third Edition, Thomson Course Technology, 2007.
5. Arnold K. and Gosling, J. “The JAVA programming language”, Third edition, Pearson Education, 2000.
6. Thomas Wu C., “An introduction to Object-oriented programming with Java”, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd., 2006.

		L	T	P	C
10133EE605	**DESIGN OF ELECTRICAL MACHINES**	**3**	**1**	**0**	**4**

AIM

To expose the students to the concept of design of various types of electrical machines.

OBJECTIVES

To provide sound knowledge about constructional details and design of various electrical machines.

To study mmf calculation and thermal rating of various types of electrical machines.

To design armature and field systems for D.C. machines.

To design core, yoke, windings and cooling systems of transformers.

To design stator and rotor of induction machines.

To design stator and rotor of synchronous machines and study their thermal behaviour.

UNIT I INTRODUCTION 9

Major considerations in Electrical Machine Design - Electrical Engineering Materials – Space factor – Choice of Specific Electrical and Magnetic loadings – Thermal considerations - Heat flow – Temperature rise - Rating of machines – Standard specifications.

UNIT II DC MACHINES 9

Output Equations – Main Dimensions - Magnetic circuit calculations – Carter's Coefficient - Net length of Iron –Real & Apparent flux densities – Selection of number of poles – Design of Armature – Design of commutator and brushes – performance prediction using design values.

UNIT III TRANSFORMERS 9

Output Equations – Main Dimensions - KVA output for single and three phase transformers – Window space factor – Overall dimensions – Operating characteristics – Regulation – No load current – Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers.

UNIT IV INDUCTION MOTORS 9

Output equation of Induction motor – Main dimensions – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor -– Magnetic leakage calculations – Leakage reactance of polyphase machines- Magnetizing current - Short circuit current – Circle diagram - Operating characteristics.

UNIT V SYNCHRONOUS MACHINES 9

Output equations – choice of loadings – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design.

L:45 T:15TOTAL : 60 PERIODS

TEXT BOOKS

1. Sawhney, A.K., “A Course in Electrical Machine Design”, Dhanpat Rai & Sons, New Delhi, 1984.
2. Sen, S.K., “Principles of Electrical Machine Designs with Computer Programmes”, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

REFERENCE BOOKS

1. Shanmugasundaram.A, Gangadharan.G, Palani.R “Electrical Machine Design Data Book”, New Age Intenational Pvt. Ltd., Reprint 2007.
2. Balbir Singh, “Electrical Machine Design”, Brite Publications, Pune.

L T P C

10144CS503 COMPUTER NETWORKS 3 0 0 3

UNIT I **9**

Introduction to networks – network architecture – network performance – Direct link networks – encoding – framing – error detection – transmission – Ethernet – Rings – FDDI - Wireless networks – Switched networks – bridges

UNIT II **9**

Internetworking – IP - ARP – Reverse Address Resolution Protocol – Dynamic Host Configuration Protocol – Internet Control Message Protocol – Routing – Routing algorithms – Addressing – Subnetting – CIDR – Inter domain routing – IPv6

UNIT III **9**

Transport Layer – User Datagram Protocol (UDP) – Transmission Control Protocol – Congestion control – Flow control – Queuing Disciplines – Congestion – Avoidance Mechanisms.

UNIT IV **9**

Data Compression – introduction to JPEG, MPEG, and MP3 – cryptography – symmetric-key – public-key – authentication – key distribution – key agreement – PGP – SSH – Transport layer security – IP Security – wireless security – Firewalls

UNIT V **9**

Domain Name System (DNS) – E-mail – World Wide Web (HTTP) – Simple Network Management Protocol – File Transfer Protocol (FTP)– Web Services - Multimedia Applications – Overlay networks

TOTAL : 45 PERIODS

TEXT BOOK

1.Larry L. Peterson and Bruce S. Davie, “Computer Networks: A Systems Approach”, Fourth Edition, Elsevier Publishers Inc., 2007.

2. Andrew S. Tanenbaum, “Computer Networks”, Fourth Edition, PHI, 2003.

REFERENCE BOOKS

1. James F. Kuross and Keith W. Ross, “Computer Networking: A Top-Down Approach Featuring the Internet”, Third Edition, Addision wesley, 2004.

2. William Stallings, “Data and Computer Communication”, Sixth Edition, Pearson Education, 2000.

3. Nader F. Mir, “Computer and communication networks”, Pearson Education, 2007

L T P C

10144CS309 OBJECT- ORIENTED PROGRAMMING LAB 0 0 3 2

AIM

To develop object-oriented programming skills using C++ and Java

1. Function overloading, default arguments in C++
2. Simple class design in C++, namespaces, objects creations
3. Class design in C++ using dynamic memory allocation, destructor, copy constructor
4. Operator overloading, friend functions
5. Overloading assignment operator, type conversions
6. Inheritance, run-time polymorphism
7. Template design in C++
8. I/O, Throwing and Catching exceptions
9. Program development using STL
10. Simple class designs in Java with Javadoc
11. Designing Packages with Javadoc comments
12. Interfaces and Inheritance in Java
13. Exceptions handling in Java
14. Java I/O
15. Design of multi-threaded programs in Java

TOTAL : 45 PERIODS

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.NO	Description of Equipment	Quantity required
	Hardware Required	
1.	Computers (Pentium-4)	40 Nos with one Server
2.	Dot matrix printer	3 Nos
3.	Laser Printer	2 Nos
4.	UPS (5 KVA)	2
	Software Required	
5.	Turbo C++	40 Nodes
6.	(Java 2 SDK) JDK 5.0 update 6(1.5.0-Internal Version No.)	40 Nos

		L T P C
10133EE609	**POWER ELECTRONICS LABORATORY**	**0 0 3 2**

AIM

To study the characteristics of switching devices and its applications in rectifier inverter, chopper and resonant converter.

List of experiments with objectives and exercises

1. Characteristics of SCR
2. Characteristics of TRIAC
3. Characteristics of MOSFET and IGBT
4. Transient characteristics of SCR and MOSFET
5. AC to DC fully controlled converter
6. AC to DC half-controlled converter
7. Step down and step up MOSFET based choppers
8. IGBT based single-phase PWM inverter
9. IGBT based three-phase PWM inverter
10. Resonant dc-to-dc converter

TOTAL : 45 PERIODS

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.NO	Description of Equipment	Quantity required
1.	Device characteristics (for SCR,MOSFET, TRIAC and IGBT) kit with built in power supply & meters	2 each
2.	SCR firing circuit module	2
3.	Single phase SCR base ½ controlled converter & fully controlled converter along with built-in / separate/ firing circuit/ module and meter	2 each
4.	MOSFET based step up and step down choppers	1 each
5.	IGBT based single phase PWM inverter module	2
6.	IGBT based three phase PWM inverter module	2
7.	IGBT based high Switching frequency chopper module with built-in controller	2
8.	Resonant DE-De converter module with built-in power supply and controller	2
9.	SCR & TRIAC based 1 phase A.C phase controller along with lamp or rheostat load	4
10.	SCR base V/I commuted chopper module with relevant firing modules (separate or built-in)	4
11.	Dual regulated Dc power supply with common ground	4
12.	Cathode ray Oscilloscope	5
13.	Isolation transformer	5
14.	Single phase Auto Transformer	3
15.	Components (Inductance, Capacitance)	3 sets for each
16.	Multi meter	5
17.	LCR meter	3
18.	Rheostats of various ranges	2 sets of 10 Value
19.	Work tables	12
20.	DC and AC meters of required ranges	20

L T P C

10133EE610 PRESENTATION SKILLS AND TECHNICAL SEMINAR 0 0 2 1

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.

L T P C

10133EE701 POWER SYSTEM OPERATION AND CONTROL 3 0 0 3

AIM

To understand the day to day operation of power system and the control actions to be implemented on the system to meet the minute-to-minute variation of system load demand.

OBJECTIVES

To have an overview of power system operation and control.

To model power-frequency dynamics and to design power-frequency controller.

To model reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.

UNIT I INTRODUCTION 9

System load – variation - load characteristics - load curves and load-duration curve (daily, weekly and annual) - load factor - diversity factor. Importance of load forecasting and simple techniques of forecasting. An overview of power system operation and control and the role of computers in the implementation. (Qualitative treatment with block diagram).

UNIT II REAL POWER - FREQUENCY CONTROL 9

Basics of speed governing mechanism and modeling - speed-load characteristics – load sharing between two synchronous machines in parallel. Control area concept LFC control of a single-area system. Static and dynamic analysis of uncontrolled and controlled cases. Integration of economic dispatch control with LFC. Two-area system – modeling - static analysis of controlled case - tie line with frequency bias control of two-area system - state variable model.

UNIT III REACTIVE POWER–VOLTAGE CONTROL 9

Basics of reactive power control. Excitation systems – modeling. Static and dynamic analysis - stability compensation - generation and absorption of reactive power. Relation between voltage, power and reactive power at a node - method of voltage control – tapchanging transformer. System level control using generator voltage magnitude setting, tap setting of OLTC transformer and MVAR injection of switched capacitors to maintain acceptable voltage profile and to minimize transmission loss.

UNIT IV COMMITMENT AND ECONOMIC DISPATCH 9

Statement of economic dispatch problem – cost of generation – incremental cost curve - co-ordination equations without loss and with loss, solution by direct method and λ- iteration method. (No derivation of loss coefficients). Statement of Unit Commitment problem – constraints; spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints. Solution methods - Priority-list methods - forward dynamic programming approach. Numerical problems only in priority-list method using full-load average production cost.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Need of computer control of power systems. Concept of energy control centre (or) load dispatch centre and the functions - system monitoring - data acquisition and control. System hardware configuration – SCADA and EMS functions. Network topology – state estimation - security analysis and control. Various operating states (Normal, alert, emergency, in-extremis and restorative). State transition diagram showing various state transitions and control strategies.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Allen. J. Wood and Bruce F. Wollenberg, “Power Generation, Operation and Control”, John Wiley & Sons, Inc., 2003.
2. Chakrabarti & Halder, “Power System Analysis: Operation and Control”, Prentice Hall of India, 2004 Edition.

REFERENCE BOOKS

1. Kothari.D.P and Nagrath.I.J, “Modern Power System Analysis”, Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003. (For Chapters 1, 2 & 3)
2. Grigsby.L.L, “The Electric Power Engineering, Hand Book”, CRC Press & IEEE Press, 2001.
3. Hadi Saadat, “Power System Analysis”, (For the chapters 1, 2, 3 and 4)11th Reprint 2007.
4. Kundur P., ‘Power System Stability and Control’ MC Craw Hill Publisher, USA, 1994.
5. Olle.I.Elgerd, “Electric Energy Systems theory An introduction” Tata McGraw Hill Publishing Company Ltd. New Delhi, Second Edition 2003.

		L T P C
10133EE702	**PROTECTION AND SWITCHGEAR**	**3 0 0 3**

AIM

To introduce the students to the various abnormal operating conditions in power system and describe the apparatus and system protection schemes. Also to describe the phenomena of current interruption to study the various switchgears

OBJECTIVES

- To discuss the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- To understand the characteristics and functions of relays and protection schemes.
- To understand the problems associated with circuit interruption by a circuit breaker.

UNIT I INTRODUCTION 9

Importance of protective schemes for electrical apparatus and power system. Qualitative review of faults and fault currents - relay terminology – definitions - and essential qualities of protection.

Protection against over voltages due to lightning and switching - arcing grounds - Peterson Coil - ground wires - surge absorber and diverters Power System earthing – neutral Earthing - basic ideas of insulation coordination.

UNIT II OPERATING PRINCIPLES AND RELAY CHARACTERISTICS 9

Electromagnetic relays – over current, directional and non-directional, distance, negative sequence, differential and under frequency relays – Introduction to static relays.

UNIT III APPARATUS PROTECTION 9

Main considerations in apparatus protection - transformer, generator and motor protection - protection of busbars. Transmission line protection - zones of protection. CTs and PTs and their applications in protection schemes.

UNIT IV THEORY OF CIRCUIT INTERRUPTION 9

Physics of arc phenomena and arc interruption. DC and AC circuit breaking – restriking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current.

UNIT V CIRCUIT BREAKERS 9

Types of circuit breakers – air blast, air break, oil, SF6 and vacuum circuit breakers – C merits of different circuit breakers – testing of circuit breakers.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Soni.M.L, Gupta.P.V, Bhatnagar.V.S, Chakrabarti.A, “A Text Book on Power System Engineering”, Dhanpat Rai & Co., 1998. (For All Chapters 1, 2, 3, 4 and 5).

2**.** Rajput.R.K, “A Text book of Power System Engineering”, Laxmi Publications, First Edition Reprint 2007.

REFERENCE BOOKS

1. Sunil S. Rao, “Switchgear and Protection”, Khanna publishers, New Delhi, 1986.
2. Wadhwa.C.L, “Electrical Power Systems”, Newage International (P) Ltd., 2000.
3. Ravindranath.B, and Chander.N, “Power System Protection & Switchgear”, Wiley Eastern Ltd., 1977.
4. Badri Ram, Vishwakarma, “Power System Protection and Switchgear”, Tata McGraw Hill, 2001.
5. Paithankar.Y.G and Bhide.S.R, “Fundamentals of Power System Protection”, Prentice Hall of India Pvt. Ltd., New Delhi, 2003.

L T P C

10144CSE26 EMBEDDED SYSTEM 3 0 0 3

AIM

To understand the basic concepts of embedded system design and its applications to various fields.

OBJECTIVES

To provide a clear understanding of

- Embedded system terminologies and its devices.
- Various Embedded software Tools
- Design and architecture of Memories.
- Architecture of processor and memory organizations.
- Input/output interfacing
- Various processor scheduling algorithms.
- Basics of Real time operating systems.
- Introduction to PIC and its applications

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to embedded real time systems – The build process for embedded systems – Embedded system design process-Embedded computory applications-Types of memory – Memory management methods.

UNIT II EMBEDDED SYSTEM ORGANIZATION 9

Structural units in processor , selection of processor & memory devices – DMA – I/O devices : timer & counting devices – Serial communication using I^2C , CAN USB buses – Parallel communication using ISA , PCI ,PCI/X buses – Device drivers

UNIT III PROGRAMMING AND SCHEDULING 9

Intel I/O instructions – Synchronization - Transfer rate, latency; interrupt driven input and output – Non-maskable interrupts, software interrupts, Preventing interrupts overrun-Disability interrupts. Multithreaded programming –Context Switching, Preemptive and non-preemptive multitasking, semaphores. Scheduling-thread states, pending threads, context switching

UNIT IV REAL-TIME OPERATING SYSTEMS 9

Introduction to basic concepts of RTOS, Unix as a Real Time Operating system – Unix based Real Time operating system - Windows as a Real time operating system – POSIX – RTOS-Interrupt handling - A Survey of contemporary Real time Operating systems: PSOS, VRTX, VxWorks, QNX, ЧC/OS-II, RT Linux – Benchmarking Real time systems - Basics,

UNIT V PIC MICROCONTROLLER BASED EMBEDDED SYSTEM DESIGN 9

PIC microcontroller – MBasic compiler and Development boards – The Basic Output and digital input – Applications

TOTAL : 45 PERIODS

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. Jack R Smith "Programming the PIC microcontroller with MBasic" Elsevier, 2007
2. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006
3. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education 2007
4. Sriram. V.Iyer & Pankaj Gupta, 'Embedded real time systems Programming', Tata McGraw Hill, 2004.
5. Wajne Wolf, 'Computer as Components ', Pearson Education

		L	T	P	C
10177GE003	**PRINCIPLES OF MANAGEMENT**	**3**	**0**	**0**	**3**

UNIT I OVERVIEW OF MANAGEMENT 9

Definition - Management - Role of managers - Evolution of Management thought - Organization and the environmental factors – Trends and Challenges of Management in Global Scenario.

UNIT II PLANNING 9

Nature and purpose of planning - Planning process - Types of plans – Objectives - - Managing by objective (MBO) Strategies - Types of strategies - Policies – Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions.

UNIT III ORGANIZING 9

Nature and purpose of organizing - Organization structure - Formal and informal groups *I* organization - Line and Staff authority - Departmentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing - Selection and Recruitment - Orientation - Career Development - Career stages – Training - - Performance Appraisal.

UNIT IV DIRECTING 9

Creativity and Innovation - Motivation and Satisfaction - Motivation Theories - Leadership Styles - Leadership theories - Communication - Barriers to effective communication - Organization Culture - Elements and types of culture – Managing cultural diversity.

UNIT V CONTROLLING 9

Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control – Maintenance Control - Quality Control - Planning operations.

TOTAL:45 PERIODS

TEXT BOOKS

1. Stephen P. Robbins and Mary Coulter, “Management”, Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, “Principles of Management”, Mcgraw Hill Education, Special Indian Edition, 2007.

REFERENCE BOOKS

1. Hellriegel, Slocum & Jackson, “Management - A Competency Based Approach”, Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, “Management - A global & Entrepreneurial Perspective”, Tata Mcgraw Hill, 12th edition, 2007.
3. Andrew J. Dubrin, “Essentials of Management”, Thomson Southwestern, 7th edition, 2007.

		L T P C
10133EE705	**RENEWABLE ENERGY SOURCES**	**3 0 0 3**

UNIT I ENERGY SCENARIO

Classification of energy sources – Energy resources: Conventional and non – conventional – Energy needs of India – Energy consumption patterns – Worldwide Potentials of these sources – Energy Efficiency – Energy Security – Energy and its environmental impacts – Global environmental concern – Kyoto Protocol – Concept of Clean Development Mechanism (CDM) and Prototype Carbon Funds (PCF) – Factors favoring and against renewable energy sources – IRP.

UNIT II SOLAR ENERGY

Solar thermal systems – Types of Collectors – Collection systems – Efficiency calculations – Applications – Photo Voltaic (PV) technology – Present status – solar cells – Cell technologies – Characteristics of PV Systems – Equivalent Circuit – Array design – Building Integrated PV System and its components – sizing and economics – Peak power operation – Satndalone and grid interactive systems.

UNIT III WIND ENERGY

Wind Energy – Wind speed and power relation – Power extracted from wind – wind distribution and wind speed predictions – Wind power systems – System components – Types of Turbine – Turbine rating – Choice of generators - Turbine rating – electrical load matching – Variable speed operation – Maximum power operation – Control systems – System design features – Standalone and grid connected operation.

UNIT IV OTHER ENERGY SOURCES

Biomass – various resources – Energy contents – Technological advancements – Conversion of Biomass in other form of energy – solid, liquid and gases – Gasifiers – Biomass fired boilers – Cofiring – Generation from municipal solid waste – Issues in harnessing these sources – Hydro energy – Feasibility of small, mini and micro hydel plants: scheme, layout and economics – Tidal and wave energy – Geothermal and Ocean-Thermal Energy Conversion (OTEC) systems – Schemes, feasibility and viability.

UNIT V ENERGY STORAGE AND HYBRID SYSTEM CONFIGURATIONS

Energy storage – Battery – Types – Equivalent circuit – Performance characteristics – battery design – Charging and charge regulators – Battery management – Fly wheel energy relations – Components – benefits over battery – Fuel cell energy – Storage systems – Ultra capacitors.

TOTAL:45 PERIODS

TEXT BOOKS

1. Rai, G.D., “Non Conventional Energy Sources”, Khanna Publishers, 1993.
2. Rao S. Paruklekar, “Energy Technology – Non Conventional, Renewable and Conventional”, Khanna Publishers, 1999.

REFERENCE BOOKS

1. Openshaw Taylor, E., "Utilisation of Electric Energy in SI Units.", Orient Longman Ltd, 2007.
2. Uppal, S.L., "Electric Power" ,13th Edition, Khanna Publishers,1997.
3. Mukund R.Patel, "Wind and Solar Power Systems", CRC Press LLC, 1999.

		L	T	P	C
10133EE707	**POWER SYSTEM SIMULATION LABORATORY**	**0**	**0**	**3**	**2**

AIM

To acquire software development skills and experience in the usage of standard packages necessary for analysis and simulation of power system required for its planning, operation and control.

OBJECTIVES

i. To develop simple C programs for the following basic requirements:

a) Formation of bus admittance and impedance matrices and network solution.

b) Power flow solution of small systems using simple method, Gauss- Seidel P.F. method.

c) Unit Commitment and Economic Dispatch.

ii. To acquire experience in the usage of standard packages for the following analysis / simulation / control functions.
a) Steady-state analysis of large system using NRPF and FDPF methods.
b) Quasi steady-state (Fault) analysis for balanced and unbalanced faults.
c) Transient stability simulation of multimachine power system.
d) Simulation of Load-Frequency Dynamics and control of power system.

1. Computation of Parameters and Modelling of Transmission Lines
2. Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
3. Load Flow Analysis - I : Solution of Load Flow And Related Problems Using Gauss-Seidel Method
4. Load Flow Analysis - II: Solution of Load Flow and Related Problems Using Newton-Raphson and Fast-Decoupled Methods
5. Fault Analysis
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System
7. Transient Stability Analysis of Multimachine Power Systems
8. Electromagnetic Transients in Power Systems
9. Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
10. Economic Dispatch in Power Systems.

TOTAL : 45 PERIODS

DETAILED SYLLABUS

1. COMPUTATION OF PARAMETERS AND MODELLING OF TRANSMISSION LINES

Aim
(i) To determine the positive sequence line parameters L and C per phase per kilometer of a three phase single and double circuit transmission lines for different conductor arrangements.
(ii) To understand modelling and performance of short, medium and long lines.

Exercises
1.1 Computation of series inductance and shunt capacitance per phase per km of a three phase line with flat horizontal spacing for single stranded and bundle conductor configuration.
1.2 Computation of series inductance and shunt capacitance per phase per km of a three phase double circuit transmission line with vertical conductor arrangement with bundle conductor.
1.3 Computation of voltage, current, power factor, regulation and efficiency at the receiving end of a three phase Transmission line when the voltage and power at the sending end are given. Use Π model.
1.4 Computation of receiving end voltage of a long transmission for a given sending end voltage and when the line is open circuited at receiving. Also compute the shunt reactor compensation to limit the no load receiving end voltage to specified value.
1.5 Determination of the voltage profile along the long transmission line for the following cases of loading at receiving end (i) no load (ii) rated load (iii) surge impedance loading and (iv) receiving end short circuited.

2. FORMATION OF BUS ADMITTANCE AND IMPEDANCE MATRICES AND SOLUTION OF NETWORKS

Aim
To understand the formation of network matrices, the bus admittance matrix **Y** and the bus impedance matrix **Z** of a power network, to effect certain required changes on these

matrices and to obtain network solution using these matrices.

Exercises

2.1 Write a program in C language for formation of bus admittance matrix **Y** of a power network using the "Two-Rule Method", given the data pertaining to the transmission lines, transformers and shunt elements. Run the program for a sample 6 bus system and compare the results with that obtained using a standard software.

2.2 Modify the program developed in 2.1 for the following:

(i) To obtain modified **Y** matrix for the outage of a transmission line, a Transformer and a shunt element.

(ii) To obtain network solution **V** given the current injection vector **I**

(iii) To obtain full **Z** matrix or certain specified columns of **Z** matrix. Verify the correctness of the modified program using 6 bus sample system * 2.3 Write a program in C language for forming bus impedance matrix **Z** using D. M

3.LOAD FLOW ANALYSIS - I : SOLUTION OF LOAD FLOW AND RELATED PROBLEMS USING GAUSS-SEIDEL METHOD

Aim

(i) To understand, the basic aspects of steady state analysis of power systems that are required for effective planning and operation of power systems.

(ii) To understand, in particular, the mathematical formulation of load flow model in complex form and a simple method of solving load flow problems of small sized system using Gauss-Seidel iterative algorithm

Exercises

3.1 Write a program in c language for iteratively solving load flow equations using Gauss-Seidel method with provision for acceleration factor and for dealing with P-V buses. Run the program for a sample 6 bus system (Base case) and compare the results with that obtained using a standard software.

3.2 Solve the "Base case" in 3.1 for different values of acceleration factor, draw the convergence characteristics "Iteration taken for convergence versus acceleration factor" and determine the best acceleration factor for the system under study.

3.3 Solve the "Base Case" in 3.1 for the following changed conditions and comment on the results obtained, namely voltage magnitude of the load buses and transmission losses:

(i) Dropping all shunt capacitors connected to network

(ii) Changing the voltage setting of generators Vgi over the range 1.00 to 1.05

(iii) Changing the tap setting of the transformers, ai, over the range 0.85 to 1.1

3.4 Resolve the base case in 3.1 after shifting generation from one generator bus to another generator bus and comment on the MW loading of lines and transformers.

4. LOAD FLOW ANALYSIS – I: SOLUTION OF LOAD FLOW AND RELATED PROBLEMS USING NEWTON-RAPHSON AND FAST DECOUPLED METHODS

Aim

(i) To understand the following for medium and large scale power systems:

(a) Mathematical formulation of the load flow problem in real variable form

(b) Newton-Raphson method of load flow (NRLF) solution

(c) Fast Decoupled method of load flow (FDLF) solution

(ii) To become proficient in the usage of software for practical problem solving in the areas of power system planning and operation.

(iii) To become proficient in the usage of the software in solving problems using Newton-Raphson and Fast Decoupled load flow methods.

Exercises

4.1 Solve the load flow problem (Base case) of a sample 6 bus system using Gauss- Seidel, Fast Decoupled and Newton-Raphson Load Flow programs for a mismatch convergence tolerance of 0.01 MW, plot the convergence characteristics and compare the convergence rate of the three methods.

4.2 Obtain an optimal (minimum transmission loss) load flow solution for the Base case loading of 6 bus sample system by trial and error approach through repeated load flow solutions using Fast Decoupled Load Flow package for different combinations of generator voltage settings, transformer tap settings, and reactive power of shunt elements.

4.3 Carry out contingency analysis on the optimal state obtained in 4.2 for outage of a transmission line using FDLF or NRLF package.

4.4 Obtain load flow solutions using FDLF or NRLF package on the optimal state obtained in 4.2 but with reduced power factor (increased Q load) load and comment on the system voltage profile and transmission loss.

4.5 Determine the maximum loadability of a 2 bus system using analytical solution as well as numerical solution using FDLF package. Draw the P-V curve of the system.

4.6 For the base case operating state of the 6 bus system in 4.1 draw the P-V curve for the weakest load bus. Also obtain the voltage Stability Margin (MW Index) at different operating states of the system.

4.7 For the optimal operating state of 6 bus system obtained in 4.2 determine the Available Transfer Capability (ATC) between a given “source bus” and a given “sink bus”

5. FAULT ANALYSIS

Aim

To become familiar with modelling and analysis of power systems under faulted condition and to compute the fault level, post-fault voltages and currents for different types of faults, both symmetric and unsymmetric.

Exercises

5.1 Calculate the fault current, post fault voltage and fault current through the branches for a three phase to ground fault in a small power system and also study the effect of neighbouring system. Check the results using available software.

5.2 Obtain the fault current, fault MVA, Post-fault bus voltages and fault current distribution for single line to ground fault, line-to-line fault and double line to ground fault for a small power system, using the available software. Also check the fault current and fault MVA by hand calculation.

5.3 Carryout fault analysis for a sample power system for LLLG, LG, LL and LLG faults and prepare the report.

6. TRANSIENT AND SMALL-SIGNAL STABILITY ANALYSIS: SINGLE MACHINE-INFINITE BUS SYSTEM

Aim

To become familiar with various aspects of the transient and small signal stability analysis of Single-Machine Infinite Bus (SMIB) system.

Exercises

For a typical power system comprising a generating, step-up transformer, double-circuit transmission line connected to infinite bus:
Transient Stability Analysis
6.1 Hand calculation of the initial conditions necessary for the classical model of the synchronous machine.
6.2 Hand computation of critical clearing angle and time for the fault using equal area criterion.
6.3 Simulation of typical disturbance sequence: fault application, fault clearance by opening of one circuit using the software available and checking stability by plotting the swing curve.
6.4 Determination of critical clearing angle and time for the above fault sequence through trial and error method using the software and checking with the hand computed value.
6.5 Repetition of the above for different fault locations and assessing the fault severity with respect to the location of fault
6.6 Determination of the steady-state and transient stability margins.
Small-signal Stability Analysis:
6.7 Familiarity with linearised swing equation and characteristic equation and its roots, damped frequency of oscillation in Hz, damping ratio and undamped natural frequency.
6.8 Force-free time response for an initial condition using the available software.
6.9 Effect of positive, negative and zero damping.

7. TRANSIENT STABILITY ANALYSIS OF MULTIMACHINE POWER SYSTEMS

Aim
To become familiar with modelling aspects of synchronous machines and network, stateof-the-art algorithm for simplified transient stability simulation, system behaviour when subjected to large disturbances in the presence of synchronous machine controllers and to become proficient in the usage of the software to tackle real life problems encountered in the areas of power system planning and operation.

Exercises
For typical multi-machine power system:
7.1 Simulation of typical disturbance sequence: fault application, fault clearance by opening of a line using the software available and assessing stability with and without controllers.
7.2 Determination of critical clearing angle and time for the above fault sequence through trial and error method using the software.

7.3 Determination of transient stability margins.
7.4 Simulation of full load rejection with and without governor.
7.5 Simulation of loss of generation with and without governor.
7.6 Simulation of loss of excitation (optional).
7.7 Simulation of under frequency load shedding scheme (optional).

8. ELECTROMAGNETIC TRANSIENTS IN POWER SYSTEMS

Aim
To study and understand the electromagnetic transient phenomena in power systems caused due to switching and faults by using Electromagnetic Transients Program (EMTP) and to become proficient in the usage of EMTP to address problems in the areas of over voltage protection and mitigation and insulation coordination of EHV systems.

Exercises
Using the EMTP software or equivalent

Simulation of single-phase energisation of the load through single-phase pi-model of a transmission line and understanding the effect of source inductance.
8.1 Simulation of three-phase energisation of the load through three-phase pi-model of a transmission line and understanding the effect of pole discrepancy of a circuit breaker.
8.2 Simulation of energisation of an open-ended single-phase distributed parameter transmission line and understanding the travelling wave effects.
8.3 Simulation of a three-phase load energisation through a three-phase distributed parameter line with simultaneous and asynchronous closing of circuit breaker and studying the effects.
8.4 Study of transients due to single line-to-ground fault.
8.5 Computation of transient recovery voltage.

9. LOAD-FREQUENCY DYNAMICS OF SINGLE-AREA AND TWOAREA POWER SYSTEMS

Aim
To become familiar with the modelling and analysis of load-frequency and tie-line flow dynamics of a power system with load-frequency controller (LFC) under different control modes and to design improved controllers to obtain the best system response.

Exercises
9.1 Given the data for a Single-Area power system, simulate the load-frequency dynamics (only governor control) of this area for a step load disturbance of small magnitude, plot the time response of frequency deviation and the corresponding change in turbine power. Check the value of steady state frequency deviation obtained from simulation with that obtained by hand calculation.
9.2 Carry out the simulation of load-frequency dynamics of the Single-Area power system in 9.1 with Load-frequency controller (Integral controller) for different values of KI (gain of the controller) and choose the best value of KI to give an "optimal" response with regard to peak over shoot, settling time, steady-state error and Mean- Sum-Squared-Error.
9.3 Given the data for a two-area (identical areas) power system, simulate the load frequency dynamics (only governor control) of this system for a step load disturbance in one area and plot time response of frequency deviation, turbine power deviation and tie-line power deviation. Compare the steady-state frequency deviation obtained with that obtained in the case of single-area system.
9.4 Carry out the simulation of load-frequency dynamics of two-area system in 9.3 for the following control modes:
(i) Flat tie-line control
(ii) Flat frequency control
(iii) Frequency bias tie-line control
and for the frequency bias Tie-line control mode, determine the optimal values of gain and frequency bias factor required to get the "best" time response.
9.5 Given the data for a two-area (unequal areas) power system, determine the best controller parameters; gains and bias factors to give an optimal response for frequency deviation and tie-line deviations with regard to peak overshoot, settling time, steady-state error and Mean-Sum-Squared-Error.

10. ECONOMIC DISPATCH IN POWER SYSTEMS

Aim
(i) To understand the basics of the problem of Economic Dispatch (ED) of optimally adjusting the generation schedules of thermal generating units to meet the system load which are required for unit commitment and economic operation of power systems.

(ii) To understand the development of coordination equations (the mathematical model for ED) without and with losses and operating constraints and solution of these equations using direct and iterative methods

Exercises

10.1. Write a program in 'C' language to solve economic dispatch problem of a power system with only thermal units. Take production cost function as quadratic and neglect transmission loss.

10.2. Write a program in 'C' language to solve economic dispatch problem of a power system. Take production cost as quadratic and include transmission loss using loss co-efficient. Use λ-iteration algorithm for solving the coordination equations.

10.3. Determine using the program developed in exercise 10.1 the economic generation schedule of each unit and incremental cost of received power for a sample power system, for a given load cycle.

10.4. Determine using the program developed in exercise 10.2 the economic generation schedule of each unit, incremental cost of received power and transmission loss for a sample system, for the given load levels.

10.5. Apply the software module developed in 10.1 to obtain an optimum unit commitment schedule for a few load levels.

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.NO	Description of Equipment	Quantity required
1.	Personal computers (Pentium-IV, 80GB, 512 MBRAM)	25
2.	Printer laser	1
3.	Dotmatrix	1
4.	Server (Pentium IV, 80GB, 1GBRAM) (High Speed Processor)	1
5.	Software: E.M.T.P/ETAP/CYME/MIPOWER/ Any power system simulation software	5 Licenses
6.	Compliers: C, C++, VB, VC++	25 users

10133EE708 COMPREHENSION **L T P C**
0 0 2 1

AIM

To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.

10133EE801 ELECTRIC ENERGY GENERATION AND UTILISATION AND CONSERVATION **L T P C**
3 0 0 3

AIM

To expose students to the main aspects of generation, utilization and conservation.

OBJECTIVES

To impart knowledge on

Generation of electrical power by conventional and non–conventional methods.
Electrical energy conservation, energy auditing and power quality.
Principle and design of illumination systems and methods of heating and welding.
Electric traction systems and their performance.
Industrial applications of electric drives.

UNIT I POWER GENERATION **9**

Review of conventional methods – thermal, hydro and nuclear based power generation. Non-conventional methods of power generation – fuel cells - tidal waves – wind – geothermal – solar - bio-mass - municipal waste. Cogeneration. Effect of distributed generation on power system operation.

UNIT II ECONOMIC ASPECTS OF GENERATION **9**

Economic aspects of power generation – load and load duration curves – number and size of units – cost of electrical energy – tariff. Economics of power factor improvement – power capacitors – power quality. Importance of electrical energy conservation – methods – energy efficient equipments. Introduction to energy auditing.

UNIT III ILLUMINATION **9**

Importance of lighting – properties of good lighting scheme – laws of illumination – photometry - types of lamps – lighting calculations – basic design of illumination schemes for residential, commercial, street lighting, and sports ground – energy efficiency lamps.

UNIT IV INDUSTRIAL HEATING AND WELDING **9**

Role electric heating for industrial applications – resistance heating – induction heating – dielectric heating - electric arc furnaces. Brief introduction to electric welding – welding generator, welding transformer and the characteristics.

UNIT V ELECTRIC TRACTION **9**

Merits of electric traction – requirements of electric traction system – supply systems – mechanics of train movement – traction motors and control – braking – recent trends in electric traction.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Wadhwa, C.L. “Generation, Distribution and Utilization of Electrical Energy”, New Age International Pvt. Ltd, 2003.
2. Gupta B.R., “Generation of Electrical Energy”, Eurasia Publishing House (P) Ltd, New Delhi, 2003.

REFERENCE BOOKS

1. Partab.H, “Art and Science of Utilisation of Electrical Energy”, Dhanpat Rai and Co, New Delhi, 2004.
2.Openshaw Taylor.E, “Utilization of Electrical Energy in SI Units”, Orient Longman Pvt. Ltd, 2003.
3. Gupta.J.B, “Utilization of Electric Power and Electric Traction”, S.K.Kataria and Sons, 2002.

10133EI704 FIBRE OPTICS AND LASER INSTRUMENTS **L T P C**
3 0 0 3

AIM

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

OBJECTIVES

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

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9

Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors and splicers – Fibre termination – Optical sources – Optical detectors.

UNIT II 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.

UNIT III 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.

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9

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.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Senior J.M., “Optical Fibre Communication – Principles and Practice”, Prentice Hall of India, 1985.
2. Wilson J. and Hawkes, J.F.B,“Introduction to Opto Electronics”, Prentice Hall of India, 2001.

REFERENCE BOOKS

1. Keiser.G, “Optical Fibre Communication”, McGraw Hill, 1995.
2. Arumugam.M, “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

L T P C

10144EEE12 VISUAL LANGUAGES AND APPLICATIONS 3 0 0 3

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.

UNIT I 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.

UNIT II 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.

UNIT III 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.

UNIT IV 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.

UNIT V 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.

TOTAL :45 PERIODS

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.

REFENENCE 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.

		L T P C
10133IC604	**ADVANCED CONTROL SYSTEM**	**3 0 0 3**

AIM

To gain knowledge in state variable analysis, non-linear systems and optimal control.

OBJECTIVES

- To study the state variable analysis
- To provide adequate knowledge in the phase plane analysis.
- To give a basic knowledge in describing function analysis.
- To analyze the stability of the systems using different techniques.
- To study the design of optimal controller.

UNIT I STATE VARIABLE ANALYSIS 9

Concept of state – State Variable and State Model – State models for linear and continuous time systems – Solution of state and output equation – controllability and observability - Pole Placement – State observer Design of Control Systems with observers.

UNIT II PHASE PLANE ANALYSIS 9

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearising non-linear systems - Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

UNIT III 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.

UNIT IV 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.

UNIT V OPTIMAL CONTROL 9

Introduction -Decoupling - Time varying optimal control – LQR steady state optimal control – Optimal estimation – Multivariable control design.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Nagrath.I.J and Gopal.M, "Control Systems Engineering", New Age International Publishers, 2003.
2. Ashish Tewari, "Modern control Design with Matlab and Simulink", John Wiley, New Delhi, 2002.

REFERENCE BOOKS

1. George J. Thaler, "Automatic Control Systems", Jaico Publishers, 1993.
2. Gopal.M, "Modern control system theory", New Age International Publishers, 2002.
3. Gene F. Franklin, J. David Powell and Abbasemami-Naeini, " Feedback Control of Dynamic Systems", Fourth edition, Pearson Education, Low price edition. 2002.

		L T P C
10133EEE14	**ROBOTICS AND AUTOMATION**	**3 0 0 3**

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.

UNIT I BASIC CONCEPTS 9

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov's laws of robotics – dynamic stabilization of robots.

UNIT II POWER SOURCES AND SENSORS 9

Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

UNIT III MANIPULATORS, ACTUATORS AND GRIPPERS 9

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

UNIT IV KINEMATICS AND PATH PLANNING 9

Solution of inverse kinematics problem – multiple solution jacobian work envelop – hill climbing techniques – robot programming languages

UNIT V CASE STUDIES 9

Mutiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., "Industrial Robotics", McGraw-Hill Singapore, 1996.
2. Ghosh, "Control in Robotics and Automation: Sensor Based Integration", Allied Publishers, Chennai, 1998.

REFERENCE BOOKS

1. Deb.S.R., "Robotics technology and flexible Automation", John Wiley, USA 1992.
2. Asfahl C.R., "Robots and manufacturing Automation", John Wiley, USA 1992.
3. Klafter R.D., Chimielewski T.A., Negin M., "Robotic Engineering – An integrated approach", Prentice Hall of India, New Delhi, 1994.
4. Mc Kerrow P.J, "Introduction to Robotics", Addison Wesley, USA, 1991.
5. Issac Asimov I , "Robot", Ballantine Books, New York, 1986.

L T P C

10177GE005 PROFESSIONAL ETHICS AND HUMAN VALUES 3 0 0 3

UNIT I ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal

UNIT IV RESPONSIBILITIES AND RIGHTS 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES 9

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TOTAL : 45 PERIODS

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, (2000).

REFERENCE BOOKS

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003)

L T P C

10133EEE16 POWER SYSTEM TRANSIENTS 3 0 0 3

AIM

To review the over voltages (or) surges due to the phenomena of switching operations and lighting discharge. Also to study propagation, reflection and refraction of these surges on the equipments their impact on the power system grid.

OBJECTIVES

- To study the generation of switching transients and their control using circuit – theoretical concept.
- To study the mechanism of lighting strokes and the production of lighting surges.
- To study the propagation, reflection and refraction of travelling waves.

UNIT I INTRODUCTION AND SURVEY 9

Review and importance of the study of transients - causes for transients. RL circuit transient with sine wave excitation - double frequency transients – basic transforms of the RLC circuit transients. Different types of power system transients - effect of transients on power systems – role of the study of transients in system planning.

UNIT II SWITCHING TRANSIENTS 9

Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - normal and abnormal switching transients. Current suppression - current chopping - effective equivalent circuit. Capacitance switching - effect of source regulation - capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients – ferro resonance.

UNIT III LIGHTNING TRANSIENTS 9

Review of the theories in the formation of clouds and charge formation - rate of charging of thunder clouds – mechanism of lightning discharges and characteristics of lightning strokes – model for lightning stroke - factors contributing to good line design – protection using ground wires - tower footing resistance - Interaction between lightning and power system.

UNIT IV TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS 9

Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewely's lattice diagram - standing waves and natural frequencies - reflection and refraction of travelling waves.

UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM 9

The short line and kilometric fault - distribution of voltages in a power system – Line dropping and load rejection - voltage transients on closing and reclosing lines – over voltage induced by faults - switching surges on integrated system. Qualitative application of EMTP for transient computation.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Allan Greenwood, “Electrical Transients in Power Systems”, Wiley Interscience, New York, 2nd edition 1991.
2. Begamudre.R.D, “Extra High Voltage AC Transmission Engineering”, Wiley Eastern Limited, 1986.

REFERENCE BOOKS

1. Naidu.M.S and Kamaraju.V, “High Voltage Engineering”, Tata McGraw Hill, 2nd edition, 2000.

		L T P C
10133EI606	**BIO–MEDICAL INSTRUMENTATION**	**3 0 0 3**

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. Biomedical applications of different transducers used.
ii. To introduce the student to the various sensing and measurement devices of electrical origin. To provide awareness of electrical safety of medical equipments
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.

UNIT I PHYSIOLOGY AND TRANSDUCERS 9

Cell and its structure – Resting and Action Potential – Nervous system: Functional organisation of the nervous system – Structure of nervous system, neurons - synapse – transmitters and neural communication – Cardiovascular system – respiratory system – Basic components of a biomedical system - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors.

UNIT II ELECTRO – PHYSIOLOGICAL MEASUREMENTS 9

Electrodes –Limb electrodes –floating electrodes – pregelled disposable 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. Electrical safety in medical environment: shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipments

UNIT III NON-ELECTRICAL PARAMETER MEASUREMENTS 9

Measurement of blood pressure – Cardiac output – Heart rate – Heart sound – Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers : pH of blood –measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements .

UNIT IV MEDICAL IMAGING 9

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Introduction to Biometric systems

UNIT V ASSISTING AND THERAPEUTIC EQUIPMENTS 9

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy

TOTAL : 45 PERIODS

TEXT BOOKS

1..Khandpur, R.S “Hand Book of Bio-Medical instrumentation”, Tata McGraw Hill Publishing Co Ltd., 2003.

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

REFERENCE BOOKS

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

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

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

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

		L T P C
10133EEE22	**INTELLIGENT CONTROL**	**3 0 0 3**

UNIT I INTRODUCTION 9

Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule-based systems, the AI approach. Knowledge representation. Expert systems.

UNIT II ARTIFICIAL NEURAL NETWORKS 9

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network. Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations. Hopfield network, Self-organizing network and Recurrent network. Neural Network based controller

UNIT III GENETIC ALGORITHM 9

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

UNIT IV FUZZY LOGIC SYSTEM 9

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control. Fuzzy logic control for nonlinear time-delay system.

UNIT V APPLICATIONS 9

GA application to power system optimisation problem, Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox. Stability analysis of Neural-Network interconnection systems. Implementation of fuzzy logic controller using Matlab fuzzy-logic toolbox. Stability analysis of fuzzy control systems

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TOTAL : 45 PERIODS

TEXT BOOKS

1. Padhy.N.P.(2005), “Artificial Intelligence and Intelligent System”, Oxford University Press.

2. Kosko,B. "Neural Networks And Fuzzy Systems", Prentice-Hall of India Pvt. Ltd., 1994.

REFERENCE BOOKS

1. Jacek.M.Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 1999.

2. Klir.G.J & Folger.T.A,"Fuzzy sets, uncertainty and Information", Prentice-Hall of India Pvt. Ltd., 1993.

3. Zimmerman H.J., "Fuzzy set theory-and its Applications"-Kluwer Academic Publishers, 1994.

4. Driankov, Hellendroon, "Introduction to Fuzzy Control", Narosa Publishers.

5. Goldberg D.E., “Genetic algorithms in Search, Optimization and Machine learning”, Addison Wesley.

L T P C

10133EEE23 POWER SYSTEM DYNAMICS 3 0 0 3

AIM

To understand the concept of modelling the power system and the components for simulating the transient and dynamic behaviour of power system meant for the stability studies.

OBJECTIVES

- To review the modeling of synchronous machine, the excitation system and speedgoverning controllers.
- To study small signal stability analysis of a single-machine infinite bus system with excitation system and power system stabilizer.
- To study transient stability simulation of multimachine power system.

UNIT I INTRODUCTION 9

Basics of system dynamics – numerical techniques – introduction to software packages to study the responses. Concept and importance of power system stability in the operation and design distinctionbetween transient and dynamic stability - complexity of stability problem in large system – necessity for reduced models - stability of interconnected systems.

UNIT II SYNCHRONOUS MACHINE MODELLING 9

Synchronous machine - flux linkage equations - Park's transformation - per unit conversion - normalizing the equations - equivalent circuit - current space model – flux linkage state space model. Sub-transient and transient inductances - time constants. Simplified models (one axis and constant flux linkage) - steady state equations and phasor diagrams.

UNIT III MACHINE CONTROLLERS 9

Exciter and voltage regulators - function and types of excitation systems – typical excitation system configuration - block diagram and state space representation of IEEE type 1 excitation system - saturation function - stabilizing circuit. Function of speed governing systems - block diagram and state space representation of IEEE mechanical hydraulic governor and electrical hydraulic governors for hydro turbines and steam turbines.

UNIT IV TRANSIENT STABILITY 9

State equation for multimachine system with one axis model and simulation – modeling of multimachine power system with one axis machine model including excitation system and speed governing system and simulation using R-K method of fourth order (Gill's technique) for transient stability analysis - power system stabilizer. For all simulations, the algorithm and flow chart have to be discussed.

UNIT V DYNAMIC STABILITY 9

System response to small disturbances - linear model of the unregulated synchronous machine and its modes of oscillation - regulated synchronous machine - distribution of power impact - linearization of the load equation for the one machine problem – simplified linear model - effect of excitation on dynamic stability - approximate system representation - supplementary stabilizing signals - dynamic performance measure - small signal performance measures.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Anderson.P.M and Fouad.A.A, “Power System Control and Stability”, Galgotia Publications, New Delhi, 2003.
2. Kundur.P, “Power System Stability and Control”, McGraw Hill Inc., USA, 1994.

REFERENCE BOOKS

1. Pai.M.A and Sauer.W, “Power System Dynamics and Stability”, Pearson Education Asia, India, 2002.
2. James A.Momoh, Mohamed.E. EI-Hawary.“ Electric Systems, Dynamics and stability with Artificial Intelligence applications”, Marcel Dekker, USA First Edition 2000.

		L T P C
10133EEE24	**COMPUTER ARCHITECTURE**	**3 0 0 3**

UNIT I INSTRUCTION SET ARCHITECTURE 9

Introduction to computer architecture - Review of digital design – Instructions and addressing – procedures and data – assembly language programs – instruction set variations

UNIT II ARITHMETIC/LOGIC UNIT 9

Number representation – design of adders – design of simple ALUs – design of Multipliers and dividers – design of floating point arithmetic unit

UNIT III DATA PATH AND CONTROL 9

Instruction execution steps – control unit synthesis – microprogramming – pipelining – pipeline performance

UNIT IV MEMORY SYSTEM 9

Main Memory concepts – types of memory – cache memory organization – secondary storage – virtual memory – paging

UNIT V I/O AND INTERFACES 9

I/O devices – I/O programming – polling – interrupts – DMA – buses – links – interfacing – context switching – threads and multithreading

TOTAL :45 PERIODS

TEXT BOOKS

1. Parhami, B. “Computer Architecture”, Oxford University Press, 2005.
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, Fifth Edition, Tata McGraw Hill, 2002.

REFERENCE BOOKS

1. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software interface”, Third Edition, Elsevier, 2004.
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Seventh Edition, Pearson Education, 2006.
3. Miles Murdocca “Computers Architecture and Organization An Integrated approach”, Wiley India pvt Ltd, 2007
4. John D. Carpinelli, “Computer systems organization and Architecture”, Pearson Education, 2001.

10133EEE25 SPECIAL ELECTRICAL MACHINES

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3	0	0	3

AIM

To expose the students to the construction, principle of operation and performance of special electrical machines as an extension to the study of basic electrical machines.

OBJECTIVES

- To impart knowledge on
- Construction, principle of operation and performance of synchronous reluctance motors.
- Construction, principle of operation, control and performance of stepping motors.
- Construction, principle of operation, control and performance of switched reluctance motors.
- Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- Construction, principle of operation and performance of permanent magnet synchronous motors.

UNIT I SYNCHRONOUS RELUCTANCE MOTORS 9

Constructional features – Types – Axial and Radial flux motors – Operating principles – Variable Reluctance and Hybrid Motors – SYNREL Motors – Voltage and Torque Equations - Phasor diagram - Characteristics.

UNIT II STEPPING MOTORS 9

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Torque equations – Modes of excitations – Characteristics – Drive circuits – Microprocessor control of stepping motors – Closed loop control.

UNIT III SWITCHED RELUCTANCE MOTORS 9

Constructional features – Rotary and Linear SRMs - Principle of operation – Torque production – Steady state performance prediction- Analytical method -Power Converters and their controllers – Methods of Rotor position sensing – Sensorless operation – Closed loop control of SRM - Characteristics.

UNIT IV PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Permanent Magnet materials – Magnetic Characteristics – Permeance coefficient - Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations – Commutation - Power controllers – Motor characteristics and control.

UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS 9

Principle of operation – Ideal PMSM – EMF and Torque equations – Armature reaction MMF – Synchronous Reactance – Sinewave motor with practical windings – Phasor diagram – Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Miller.T.J.E, “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, Oxford, 1989.
2. Kenjo, “Stepping Motors and Their Microprocessor Controls”, Clarendon Press London, 1984.

REFERENCE BOOKS

1. Krishnan.R, “Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application", CRC Press, New York, 2001.
2. Aearnley.P.P, “Stepping Motors – A Guide to Motor Theory and Practice”, Peter Perengrinus, London, 1982.
3. Kenjo.T and Nagamori.S, “Permanent Magnet and Brushless DC Motors”, Clarendon Press, London, 1988.

		L T P C
10133EEE31	**POWER QUALITY**	**3 0 0 3**

AIM

To study the various issues affecting power quality, their production, monitoring and suppression.

OBJECTIVES

- To study the production of voltages sags, overvoltages and harmonics and methods of control.
- To study various methods of power quality monitoring.

UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and definitions: Overloading - under voltage - over voltage. Concepts of transients - short duration variations such as interruption - long duration variation such as sustained interruption. Sags and swells - voltage sag - voltage swell – voltage imbalance - voltage fluctuation - power frequency variations. International standards of power quality. Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT II VOLTAGE SAGS AND INTERRUPTIONS 9

Sources of sags and interruptions - estimating voltage sag performance. Thevenin's equivalent source - analysis and calculation of various faulted condition. Voltage sag due to induction motor starting. Estimation of the sag severity - mitigation of voltage sags, active series compensators. Static transfer switches and fast transfer switches.

UNIT III OVERVOLTAGES 9

Sources of over voltages - Capacitor switching – lightning - ferro resonance. Mitigation of voltage swells - surge arresters - low pass filters - power conditioners. Lightning rotection – shielding - line arresters - protection of transformers and cables. An introduction to computer analysis tools for transients, PSCAD and EMTP.

UNIT IV HARMONICS 9

Harmonic sources from commercial and industrial loads, locating harmonic sources. Power system response characteristics - Harmonics Vs transients. Effect of harmonics - harmonic distortion - voltage and current distortion - harmonic indices - inter harmonics – resonance. Harmonic distortion evaluation - devices for controlling harmonic distortion - passive and active filters. IEEE and IEC standards.

UNIT V POWER QUALITY MONITORING 9

Monitoring considerations - monitoring and diagnostic techniques for various power quality problems - modeling of power quality (harmonics and voltage sag) problems by mathematical simulation tools - power line disturbance analyzer – Quality measurement equipment - harmonic / spectrum analyzer - flicker meters - disturbance analyzer. Applications of expert systems for power quality monitoring.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Roger. C. Dugan, Mark. F. McGranagham, Surya Santoso, H.Wayne Beaty, “Electrical Power Systems Quality”, McGraw Hill,2003.(For Chapters1,2,3, 4 and 5)

REFERENCE BOOKS

1. Heydt.G.T, “Electric Power Quality”, 2nd Edition. (West Lafayette, IN, Stars in a Circle Publications, 1994). (For Chapter 1, 2, 3 and 5)
2. Bollen.M.H.J, “Understanding Power Quality Problems: Voltage Sags and Interruptions”, (New York: IEEE Press, 1999). (For Chapters 1, 2, 3 and 5)
3. Arrillaga.J, Watson.N.R, Chen.S, “Power System Quality Assessment”, (New York: Wiley, 1999). (For Chapters 1, 2, 3, 4 and 5)
4. PSCAD User Manual.

L T P C

10144CS405 OPERATING SYSTEMS 3 0 0 3

AIM

To learn the various aspects of operating systems such as process management, memory management, file systems, and I/O management

UNIT I PROCESSES AND THREADS 9

Introduction to operating systems – review of computer organization – operating system structures – system calls – system programs – system structure – virtual machines. Processes: Process concept – Process scheduling – Operations on processes – Cooperating processes – Interprocess communication – Communication in client-server systems. Case study: IPC in Linux. Threads: Multi-threading models – Threading issues. Case Study: Pthreads library

UNIT II PROCESS SCHEDULING AND SYNCHRONIZATION 10

CPU Scheduling: Scheduling criteria – Scheduling algorithms – Multiple-processor scheduling – Real time scheduling – Algorithm Evaluation. Case study: Process scheduling in Linux. Process Synchronization: The critical-section problem – Synchronization hardware – Semaphores – Classic problems of synchronization – critical regions – Monitors. Deadlock: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock.

UNIT III STORAGE MANAGEMENT 9

Memory Management: Background – Swapping – Contiguous memory allocation – Paging – Segmentation – Segmentation with paging. Virtual Memory:Background – Demand paging – Process creation – Page replacement –Allocation of frames – Thrashing. Case Study: Memory management in Linux

UNIT IV FILE SYSTEMS 9

File-System Interface: File concept – Access methods – Directory structure –Filesystem mounting – Protection. File-System Implementation : Directory implementation Allocation methods – Free-space management – efficiency and performance – recovery – log-structured file systems. Case studies: File system in Linux – file system in Windows XP

UNIT V I/O SYSTEMS 8

I/O Systems – I/O Hardware – Application I/O interface – kernel I/O subsystem – streams – performance. Mass-Storage Structure: Disk scheduling – Disk management – Swap-space management – RAID – disk attachment – stable storage – tertiary storage. Case study: I/O in Linux

TOTAL: 45 PERIODS

TEXT BOOKS

1. Silberschatz, Galvin, and Gagne, “Operating System Concepts”, Sixth Edition, Wiley India Pvt Ltd, 2003.
2. Dhamdhere D. M, “Operating Systems: A concepts based approach”, Second.Edition, Tata McGraw-Hill Publishing Company Ltd., 2006.

REFERENCE BOOKS

1. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Pearson Education/PHI, 2001.
2. Harvey M. Deital, “Operating Systems”, Third Edition, Pearson Education, 2004.

		L T P C
10133EEE33	**OPERATIONS RESEARCH**	**3 0 0 3**

AIM

To introduce the Linear Programming methods, Algorithms, LC PM and PERT.

OBJECTIVES

- To study various LP methods.
- To study Algorithms methods.
- To study case studies using CPM and PERT

UNIT I INTRODUCTION 9

Role of Operations Research - Operations Research Models and techniques. LP model and technique – formulation and graphical Solution – graphical sensitivity Analysis. The Simplex Algorithm – the two phase method – degeneracy – alterative optima – unbounded and/or Infeasible Solution – redundancies.

UNIT II PROBLEM FORMULATION 9

Definitions of the Dual Problem – Primal-dual Relationship – Economic Interpretation of Duality – Dual Simplex Method – Primal Dual Computation – Post Optimal or Sensitivity Analysis – Changes Affecting Feasibility – Changes Affecting Optimality – Revised Simplex Method – LP Packages.

UNIT III ALGORITHMS AND MODELS 9

Definition of Transportation Model – The Transportation Algorithm – Determination of the Starting Solution – Iterative Computations of an Algorithm – The Assignment Model – The Hungarian Method – The Transshipment Model – Inter Programming Problem – Cutting Plane Algorithm.

UNIT IV NETWORK SOLUTIONS 9

Scope of Network Applications – Network Solution – Minimal Spanning Tree Algorithm – Shortest Route Problem – Examples – Shortest Route Algorithm – Maximal Flow Model – Minimal cost Capacitated Flow Problems.

UNIT V CASE STUDIES USING CPM AND PERT 9

Network Diagram Representation – Critical Path Method – Time Estimates – Crashing – Time Charts – PERT and CPM for Project Scheduling – Resource Planning – Case Studies.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Hamdy A. Taha, “Operation Research – An Introduction” ,7th Edition Person Education / Prentice Hall of India Edition, Asia, 2002. (For All Chapters 1, 2, 3, 4 and 5)
2. Srinivasan, “Operations Research: Principles and applications”, Prentice Hall of India, 2007 New Edition, (For All Chapters).

REFERENCE BOOKS

1. Ronald. L. Rardin , “Optimization in Operation Research”, Pearson Education, Asia, 2002.
2. Jit.S Chandran, Mahendran P.Kawatra ,Ki Ho Kim , “Essential of Linear Programming”, Vikas Publishing House Pvt. Ltd., New Delhi, 1994.
3. Hiller F.S, Liberman G.J ,”Introduction to Operation Research”, 7th Edition, McGraw Hill, 2001. (For all Chapters 1, 2, 3, 4 and 5)
4. R.Panneer Selvam ,”Operations Research”, Prentice Hall of India, 2002.
5. P.C.Tulsin,”Quantitative Technique : Theory and Problem”, Pearson Education, 2002.
6. Ravindran, Phillips, Solberg , “Operation Research Principles and Practice”, Second Edition, John Wiley, 1987.

L T P C

10144EC605 VLSI DESIGN 3 0 0 3

AIM

Tounderstand the basic concepts of VLSI and CMOS design.

OBJECTIVES

- To give clear idea about the basics of VLSI design and its importance.
- To know about the operating principles of MOS transistor.
- To study about construction of NMOS, CMOS and Bi-CMOS based logic gates.
- To understand the functioning of programmable and Reprogrammable devices.
- To learn about the programming of Programmable device using Hardware description Language.

UNIT I BASIC MOS TRANSISTOR 9

Enhancement mode & Depletion mode – Fabrication (NMOS, PMOS, CMOS, BiCMOS) Technology – NMOS transistor current equation – second order effects – MOS Transistor Model.

UNIT II NMOS & CMOS INVERTER AND GATES 9

NMOS & CMOS inverter – Determination of pull up / pull down ratios – stick diagram – lambda based rules – super buffers – BiCMOS & steering logic.

UNIT III 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.

UNIT IV DESIGN OF COMBINATIONAL ELEMENTS & REGULAR ARRAYLOGIC 9

NMOS PLA – Programmable Logic Devices - Finite State Machine PLA – Introduction to FPGA, CPLD.

UNIT V VHDL PROGRAMMING 9

RTL Design – Detructured level Design -combinational logic – Types – Operators – Packages – Sequential circuit – Sub programs – Test benches. (Examples: address, counters, flipflops, FSM, Multiplexers / Demltiplexers).

TOTAL : 45 PERIODS

TEXT BOOKS

1. Pucknell.D.A, Eshraghian.K, “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. Weste.N.H, “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”, 2n Edition, Tata McGraw Hill, 1998.
4. Douglas Perry, “VHDL Programming By Example”, Tata McGraw Hill, 3rdEdition.2007.
5. Parag K.Lala, “Digitl System Design using PLD”, BS Publications, 2003.

L T P C

10133EEE35 HIGH VOLTAGE DIRECT CURRENT TRANSMISSION 3 0 0 3

AIM

To develop the skills in the area of HVDC power transmission with the analysis of HVDC converters, harmonics and design of filters.

OBJECTIVES

- To understand the concept, planning of DC power transmission and comparison with AC power transmission.
- To analyze HVDC converters.
- To study about compounding and regulation.
- To analyze harmonics and design of filters.
- To learn about HVDC cables and simulation tools.

UNIT I INTRODUCTION 9

Introduction of DC Power transmission technology – Comparison of AC and DC transmission – Application of DC transmission – Description of DC transmission system – Planning for HVDC transmission – Modern trends in DC transmission.

UNIT II ANALYSIS OF HVDC CONVERTERS 9

Pulse number – Choice of converter configuration – Simplified analysis of Graetz circuit – Converter bridge characteristics – Characteristics of a twelve pulse converter – Detailed analysis of converters.

UNIT III COMPOUNDING AND REGULATIONS 9

General – Required regulation – Inverter compounding – Uncompounded inverter – Rectifier compounding – Transmission characteristics with the rectifier and inverter compounding – Communication link – Current regulation from the inverter side – Transformer tap changing

UNIT IV HARMONICS AND FILTERS 9

Introduction – Generation of harmonics – Design of AC filters and DC filters – Interference with neighbouring communication lines.

UNIT V HVDC CABLES AND SIMULATION OF HVDC SYSTEMS 9

Introduction of DC cables – Basic physical phenomenon arising in DC insulation – Practical dielectrics – Dielectric stress consideration – Economics of DC cables compared with AC cables. Introduction to system simulation – Philosophy and tools – HVDC system simulation – Modeling of HVDC systems for digital dynamic simulation.

TOTAL : 45 PERIODS

TEXT BOOK

1. Padiyar, K. R., “HVDC power transmission system”, Wiley Eastern Limited, New Delhi 1990. First edition.
2. Edward Wilson Kimbark, “Direct Current Transmission”, Vol. I, Wiley interscience, New York, London, Sydney, 1971.

REFERENCE BOOKS

1. Colin Adamson and Hingorani N G, “High Voltage Direct Current Power Transmission”, Garraway Limited, London, 1960.
2. Arrillaga, J., “High Voltage Direct Current Transmission”, Peter Pregrinus, London, 1983.
3. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering”, New Age Interantional (P) Ltd., New Delhi, 1990.

		L T P C
10177GE006	**FUNDAMENTAL OF NANOSCIENCE**	**3 0 0 3**

UNIT I INTRODUCTION 9

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II PREPARATION METHODS 10

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES 7

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

UNIT IV PREPARATION ENVIRONMENTS 9

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

UNIT V CHARECTERISATION TECHNIQUES 10

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

TOTAL : 45 PERIODS

TEXT BOOKS

1. Edelstein A.S. and Cammearata R.C., eds., “Nanomaterials: Synthesis, Properties and Applications”, (Institute of Physics Publishing, Bristol and Philadelphia, 1996)
2. John Dinardo.N, “Nanoscale charecterisation of surfaces & Interfaces”, Second edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES BOOKS

1. Timp.G (Editor), “Nanotechnology”, AIP press/Springer, 1999
2. Akhlesh Lakhtakia (Editor) ,“The Hand Book of Nano Technology- “Nanometer Structure, Theory, Modeling and Simulations”, Prentice-Hall of India (P) Ltd, New Delhi, 2007.

L T P C

10133EEE42 MICRO ELECTRO MECHANICAL SYSTENS 3 0 0 3

AIM

The aim of this course is to educate the student to understand the fundamentals of Micro Electro Mechanical Systems (MEMS)

OBJECTIVES

At the end of this course the student will be able to

- integrate the knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- understand the rudiments of Microfabrication techniques.
- identify and understand the various sensors and actutators
- different materials used for MEMS
- applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT I INTRODUCTION 9

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Microfabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II SENSORS AND ACTUATORS-I 9

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators.

UNIT III SENSORS AND ACTUATORS-II 9

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT IV MICROMACHINING 9

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micromachining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – Assembly of 3D MEMS – Foundry process.

UNIT V POLYMER AND OPTICAL MEMS 9

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Chang Liu, “Foundations of MEMS”, Pearson Education Inc., 2006.
2.. James J.Allen, “Micro electro mechanical system design”, CRC Press published in 2005

REFERENCE BOOKS

1. Nadim Maluf, “ An introduction to Micro electro mechanical system design”, Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, “ The MEMS Handbook”, CRC press Baco Raton, 2000
3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002.
4. Julian w. Gardner, Vijay k. varadan, Osama O.Awadelkarim, “Micro sensors MEMS and smart devices”, John Wiley & sons,2002

L T P C

10133EEE43 SOFTWARE FOR CIRCUIT SIMULATION 3 0 0 3

UNIT I INTRODUCTION 9

Importance of simulation – General purpose circuit analysis – programs – Method of analysis of power electronic systems – Review of modeling of power electronic components and systems.

UNIT II ADVANCED TECHNIQUES IN SIMULATION 9

Analysis of power electronic systems in a sequential manner coupled and decoupled systems – Various algorithms for computing steady state solution in power electronic systems – Future trends in computer simulation.

UNIT III PSPICE : 9

Introduction – Pspice overview – DC circuit Analysis –AC circuit analysis – Transient and the time domain – Fourier Series and Harmonic components – An introduction to Pspice devices BJT, FET, MOSFET and is model – Amplifiers and Oscillators – Nor linear Devices.

UNIT IV MATLAB 9

Introduction - function description – Data types – Tool boxes – Graphical Display: Import and Export of data – Programs for solution of state equations.

UNIT V SIMULINK 9

Introduction – Graphical user Interface – Selection of objects – Blocks – lines Simulation - Application programs.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Rajagopalan.V “Computer aided analysis of power electronic systems”, Marcell Dekker 1987.

REFERENCE BOOKS

1. John Keown “Microsim Pspice and circuit analysis” Prentice hall Inc, 1998.
2. Orcad Pspice User manual, Orcad Corporation, 2006.
3. Matlab / Simulink manual, Maths Work 2007.

		L	T	P	C
10133EEE44	**COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS**	**3**	**0**	**0**	**3**

AIM

To introduce the basics of Computer Aided Design technology for the design of Electrical Machines.

OBJECTIVE

At the end of this course the student will be able to

- Learn the importance of computer aided design method.
- Understand the basic electromagnetic field equations and the problem formulation for CAD applications.
- Become familiar with Finite Element Method as applicable for Electrical Engineering.
- Know the organization of a typical CAD package.
- Apply Finite Element Method for the design of different Electrical apparatus.

UNIT I INTRODUCTION 8

Conventional design procedures – Limitations – Need for field analysis based design – Review of Basic principles of energy conversion – Development of Torque/Force.

UNIT II MATHEMATICAL FORMULATION OF FIELD PROBLEMS 9

Electromagnetic Field Equations – Magnetic Vector/Scalar potential – Electrical vector /Scalar potential – Stored energy in Electric and Magnetic fields – Capacitance - Inductance- Laplace and Poisson's Equations – Energy functional.

UNIT III PHILOSOPHY OF FEM 10

Mathematical models – Differential/Integral equations – Finite Difference method – Finite element method – Energy minimization – Variational method- 2D field problems – Discretisation – Shape functions – Stiffness matrix – Solution techniques.

UNIT IV CAD PACKAGES 9

Elements of a CAD System –Pre-processing – Modelling – Meshing – Material properties- Boundary Conditions – Setting up solution – Post processing.

UNIT V DESIGN APPLICATIONS 9

Voltage Stress in Insulators – Capacitance calculation - Design of Solenoid Actuator – Inductance and force calculation – Torque calculation in Switched Reluctance Motor.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Salon.S.J, “Finite Element Analysis of Electrical Machines”, Kluwer Academic Publishers, London, 1995.
2. Nicola Bianchi, “Electrical Machine Analysis using Finite Elements”, CRC Taylor& Francis, 2005.

REFERENCE BOOKS

1. Joao Pedro, Bastos.A and Nelson Sadowski, “Electromagnetic Modeling by Finite Element Methods”, Marcell Dekker Inc., 2003.
2. Silvester.P.P and Ferrari, “Finite Elements for Electrical Engineers”, Cambridge University Press, 1983.
3. Lowther.D.A and Silvester.P.P, “Computer Aided Design in Magnetics”, Springer Verlag, New York, 1986.
4. Hoole.s.R.H, “Computer Aided Analysis and Design of Electromagnetic Devices”, Elsevier, New York, 1989.5. User Manuals of Magent, Maxwell & Ansys Softwares.

		L	T	P	C
10133EEE45	**FLEXIBLE AC TRANSMISSION SYSTEMS**	**3**	**0**	**0**	**3**

AIM

To enhance the transmission capability of transmission system by shunt and series compensation using static controllers.

OBJECTIVES

- To understand the concept of flexible AC transmission and the associated problems.
- To review the static devices for series and shunt control.
- To study the operation of controllers for enhancing the transmission capability.

UNIT I INTRODUCTION 9

The concept of flexible AC transmission - reactive power control in electrical power transmission lines -uncompensated transmission line – series and shunt compensation. Overview of FACTS devices - Static Var Compensator (SVC) – Thyristor Switched Series capacitor (TCSC) – Unified Power Flow controller (UPFC) - Integrated Power Flow Controller (IPFC).

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9

Voltage control by SVC – advantages of slope in dynamic characteristics – influence of SVC on system voltage. Applications - enhancement of transient stability – steady state power transfer – enhancement of power system damping – prevention of voltage instability.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR(TCSC)AND APPLICATIONS 9

Operation of the TCSC - different modes of operation – modeling of TCSC – variable reactance model – modeling for stability studies. Applications - improvement of the system stability limit – enhancement of system damping – voltage collapse prevention.

UNIT IV EMERGING FACTS CONTROLLERS 9

Static Synchronous Compensator (STATCOM) – operating principle – V-I characteristics – Unified Power Flow Controller (UPFC) – Principle of operation - modes of operation – applications – modeling of UPFC for power flow studies.

UNIT V CO-ORDINATION OF FACTS CONTROLLERS 9

FACTs Controller interactions – SVC–SVC interaction - co-ordination of multiple controllers using linear control techniques – Quantitative treatment of control coordination.

TOTAL : 45 PERIODS

TEXT BOOK

1. Mohan Mathur, R., Rajiv. K. Varma, “Thyristor – Based Facts Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc.

REFERENCE BOOKS

1..John, A.T “Flexible AC Transmission System”, Institution of Electrical and Electronic Engineers (IEEE), 1999.

2. Narain G.Hingorani, Laszio. Gyugyl, “Understanding FACTS Concepts and Technology of Flexible AC Transmission S System”, Standard Publishers, Delhi 2001