ANNA UNIVERSITY :: CHENNAI 600 025

UNIVERSITY DEPARTMENTS

REGULATIONS – 2008

CURRICULUM FROM III TO VIII SEMESTERS FOR

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER III

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MA9211	Mathematics – III	3	1	0	4
EC9215	Electronic Devices and Circuits	3	1	0	4
EE9201	Control Systems	3	1	0	4
EE9202	Electromagnetic Theory	3	0	0	3
EE9203	Measurements and Instrumentation	3	0	0	3
EE9204	Digital System Design	3	1	0	4
PRACTICAL					
EC9214	Electronics Laboratory	0	0	3	2
EE9205	Control and Instrumentation laboratory	0	0	3	2
EE9206	Field Measurement and Computation Laboratory	0	0	3	2
	TOTAL	**18**	**4**	**9**	**28**

SEMESTER IV

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
EC9261	Communication Engineering	3	0	0	3
EE9251	Transmission and Distribution	3	0	0	3
EE9252	Microprocessors and Microcontrollers	3	0	0	3
EE9253	Electrical Machines – I	3	1	0	4
EE9254	Digital Signal Processing	3	0	0	3
	Elective – I	3	1	0	4
PRACTICAL					
EE9255	Microprocessor and Microcontroller Laboratory	0	0	3	2
EE9256	Electrical Machines Laboratory – I	0	0	3	2
	TOTAL	**18**	**2**	**6**	**24**

SEMESTER V

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
EE9301	Power Electronics	3	1	0	4
EE9302	Power System Analysis	3	1	0	4
EE9303	Linear Integrated Circuits	3	1	0	4
EE9304	Electrical Machines – II	3	1	0	4
EE9305	Data Structures and Algorithms	3	0	0	3
EE9306	Protection and Switchgear	3	0	0	3
PRACTICAL					
EE9307	Electrical Machines Laboratory - II	0	0	3	2
EE9308	Power Electronics Laboratory	0	0	3	2
GE9371	Communication skills and soft skills	0	0	2	1
	TOTAL	**18**	**4**	**8**	**27**

SEMESTER VI

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
EE9351	Embedded System Design	3	1	0	4
EE9352	High Voltage Engineering	3	0	0	3
EE9353	Power System Operation and Control	3	0	0	3
EE9354	Data Communication and Computer Networks	3	0	0	3
EE9355	Design of Electrical Apparatus	3	1	0	4
	Elective – II	3	0	0	3
PRACTICAL					
EE9357	Power System Simulation laboratory	0	0	3	2
EE9358	High Voltage Laboratory	0	0	3	2
EE9359	Technical Seminar	0	0	2	1
	TOTAL	**18**	**2**	**8**	**25**

SEMESTER VII

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
EE9401	Solid State Drives	3	0	0	3
EE9402	Utilization and Conservation of Electrical Energy	3	0	0	3
GE9261	Environmental Science and Engineering	3	0	0	3
	Elective –III	3	0	0	3
	Elective-IV	3	0	0	3
	Elective-V	3	0	0	3
PRACTICAL					
EE9403	Comprehension	0	0	2	1
EE9404	Design laboratory	0	0	3	2
	TOTAL	**18**	**0**	**5**	**21**

SEMESTER VIII

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
	Elective-VI	**3**	**0**	**0**	**3**
	Elective-VII	**3**	**0**	**0**	**3**
PRACTICAL					
EE9451	Project Work	**0**	**0**	**12**	**6**
	TOTAL	**6**	**0**	**12**	**12**

LIST OF ELECTIVES FOR B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

CODE NO	COURSE TITLE	L	T	P	C
MA9262	Numerical Methods	3	1	0	4
MA9265	Discrete Mathematics	3	1	0	4
MA9267	Statistics and Linear Programming	3	1	0	4
MA9268	Statistics and Numerical Methods	3	1	0	4
EE9049	Control System Design	3	0	0	3
EE9048	Advanced Control System	3	0	0	3
EE9022	Digital Control and Instrumentation	3	0	0	3
MG9401	Principles of Management	3	0	0	3
GE9022	Total Quality Management	3	0	0	3
GE9074	Engineering Economics and Financial Accounting	3	0	0	3
EE9026	Project Work	3	0	0	3
GE9023	Fundamentals of Nanoscience	3	0	0	3
EE9028	Computer Architecture	3	0	0	3
EE9029	Operating Systems	3	0	0	3
EE9030	Soft Computing	3	0	0	3
EE9031	Operations Research	3	0	0	3
EE9032	Programming in JAVA	3	0	0	3
EE9033	Advanced Topics in Power Electronics	3	0	0	3
EE9034	Power Quality	3	0	0	3
EE9035	Power System Transients	3	0	0	3
EE9036	Special Electrical Machines	3	0	0	3
EE9037	EHV Power Transmission	3	0	0	3
EE9038	Flexible AC Transmission System	3	0	0	3
EE9039	Advanced Power System Analysis	3	1	0	4
EE9040	Micro Electro Mechanical Systems	3	0	0	3
EE9041	VLSI Design	3	0	0	3
EE9042	Mobile Communication	3	0	0	3
EE9043	CAD for Electrical Apparatus	2	0	2	3
EE9044	Dynamic Modeling and Analysis of Electrical Machines	3	0	0	3
EE9045	High Voltage Direct Current Transmission	3	0	0	3
EE9046	AI Application to Power systems	3	0	0	3
EE9047	Mini Project	0	0	3	3

MA9211 MATHEMATICS III L T P C
(Common to all branches of BE / B.Tech Programmes) 3 1 0 4

AIM:

To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

OBJECTIVES:

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems

UNIT I FOURIER SERIES 9+3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORM 9+3

Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 9+3

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange's Linear equation – Integral surface passing through a given curve – Solution of linear equations of higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3

Method of separation of Variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 9+3

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value theorems – Formation of difference equation – Solution of difference equation using Z-transform.

L: 45, T: 15, TOTAL: 60 PERIODS

TEXT BOOK:

1. Grewal, B.S. "Higher Engineering Mathematics", Khanna Publications (2007)

REFERENCES:

1. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education (2007)
2. Ramana B.V., "Higher Engineering Mathematics" Tata McGraw Hill (2007).
3. Bali N.P. and Manish Goyal, "A Text Book of Engineering" 7th Edition (2007) Lakshmi Publications (P) Limited, New Delhi.

EC9215 ELECTRONIC DEVICES AND CIRCUITS L T P C
3 1 0 4

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:
- P-N junction diode, Bipolar transistor, Field Effect transistor, LED, LCD and other photo electronic devices, Power control/regulator devices, Feedback amplifiers and oscillators

UNIT I PN JUNCTION DEVICES 9+3

PN junction diode –structure, operation and V-I characteristic-current equation of drift current density and diffusion current density-diffusion and transient capacitance –display devices- LED, Laser diodes Zener breakdown-zener reverse characteristic – zener as regulator

UNIT II BIPOLAR JUNCTION TRANSISTORS 9+3

– structure , operation and V-I characteristic- MOSFET – structure, operation and V-I characteristic – types of MOSFET – JFET –structure, operation and V-I characteristic

UNIT III AMPLIFIERS 9+3

BJT small signal model – biasing – analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model – biasing – analysis of CS and source follower – gain and frequency response.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9+3

BIMOS cascade amplifier, differential amplifier – common mode and difference mode analysis – FET input stages – tuned amplifiers- single tuned amplifiers – gain and frequency response – neutralization methods.

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9+3

Advantages of negative feedback – voltage ./ current, series , shunt feedback – positive feedback – condition for oscillations, phase shift – Wien bridge, Hartley, colpitts and crystal oscillators.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. David A. Bell ,"Electronic devices and circuits", Prentice Hall of India, 2004.
2. Seda smith, "Microelectronic circuits " Oxford University Press, 2004.

REFERENCES:

1. Rashid, "Micro electronic circuits" Thomson publications, 1999.
2. Floyd, "Electron devices" Pearson Asia 5th Edition, 2001.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGrawHill, 3rd Edition, 2003.

EE9201 **CONTROL SYSTEMS** **L T P C**
3 1 0 4

AIM

To learn the concepts of linear Systems theory and its analysis.

OBJECTIVES

To impart knowledge on

- Different system representation, block diagram reduction and Mason's rule.
- Time response analysis of LTI systems and steady state error.
- The open loop and closed loop frequency responses of systems.
- Stability concept.
- State variable analysis.

UNIT I MATHEMATICAL MODELS OF PHYSICAL SYSTEMS 9+3

Definition & classification of system – terminology & structure of feedback control theory –Analogous systems - Physical system representation by Differential equations – Block diagram reduction– Signal flow graphs.

UNIT II TIME RESPONSE ANALYSIS & ROOT LOCUS TECHNIQUE 9+3

Standard test signals – Steady state error & error constants – Time Response of I and II order system – Root locus – Rules for sketching root loci.

UNIT III FREQUENCY RESPONSE ANALYSIS 9+3

Correlation between Time & Frequency response – Polar plots – Bode Plots – Determination of Transfer Function from Bode plot.

UNIT IV STABILITY CONCEPTS & ANALYSIS 9+3

Concept of stability – Necessary condition – RH criterion – Relative stability – Nyquist stability criterion – Stability from Bode plot – Relative stability from Nyquist & Bode – Closed loop frequency response.

UNIT V STATE VARIABLE ANALYSIS 9+3

Concept of state – State Variable & State Model – State models for linear & continuous time systems – Solution of state & output equation – controllability & observability.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Nagrath I.J & M. Gopal, Control systems Engineering, 4th Edition, New Age International, New Delhi, 2005.
2. Benzamin C. Kuo, Automatic Control systems, 7th Edition, Prentice-Hall (Pearson Education, Inc.), New Delhi, 2003.

REFERENCES:

1. Norman S. Nise, Control Systems Engineering, 4th Edition, John Wiley, New Delhi, 2007.
2. Richard C Dorf, Robert H Bishop, Modern control systems , 8th edition, Prentice Hall (Pearson education, Inc.), New Delhi 2003.
3. Benzamin C. Kuo and Farid Golnaraghi, Automatic Control systems, 8th Edition, John Wiley, New Delhi, 2003.
4. Eronini umez – Eronini – System Dynamics & Control, Thomson, New Delhi, 1999.

EE9202 ELECTROMAGNETIC THEORY L T P C
3 0 0 3

AIM

To introduce the fundamentals of electromagnetic fields and their applications in Engineering.

OBJECTIVES

To impart knowledge on vector fields - electrostatic and magnetostatic fields, electrodynamics and electromagnetic waves.

UNIT I INTRODUCTION 6

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 12

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

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 – Applications.

UNIT IV ELECTRO DYNAMIC FIELDS 9

Faraday's law, induced emf – transformer and motional EMF, Maxwell's equations (differential and integral forms)- Displacement current – Applications - 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 - Applications

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Matthew. N.O. Sadiku, "Elements of Electromagnetics", Fourth Edition, Oxford University Press, First Indian Edition 2007.
2. Ashutosh Pramanik, "Electromagnetism – theory and application," Prentice Hall of India Private Ltd., New Delhi, 2006.

REFERENCES:

1. William H.Hayt Jr. and John A Buck “Engineering Electromagnetics”, Seventh Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2006.
2. J.A.Edminister, Schaum’s Outlines “Theory and problems of Electromagnetics”, Tata Mc Graw hill, Second Edition, Special Indian Edition 2006.
3. Guru and Hiziroghu “Electromagnetic field theory fundamentals”, Thomson Asia Pvt. Ltd., 1998.
4. John D Kraus, Daniel A Fleisch “Electromagenetics with Applications”, Tata McGraw Hill International Edition, 1999.

EE9203 MEASUREMENTS AND INSTRUMENTATION L T P C
3 0 0 3

AIM

To provide adequate knowledge of measurements techniques using electrical and electronic instruments.

OBJECTIVES

- Introduction to general instrument system, error, calibration etc.
- Emphasis is laid on analog and digital techniques used to measure voltage, current, energy, power and non-electrical parameters.
- To have an adequate knowledge of comparison methods of measurement.
- Elaborate discussion about storage & display devices.
- Exposure to various transducers and data acquisition system.

UNIT I QUALITIES OF MEASUREMENT 9

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

UNIT II PRIMARY SENSING ELEMENTS AND SIGNAL CONDITIONING 9

Principles, Classification of sensors and transducers – Selection of transducers – Resistive, capacitive & inductive transducers – Piezoelectric, optical and digital transducers – Basic Instrumentation Amplifier, Sample and Hold Circuit, A/D and D/A converters

UNIT III ELECTRICAL MEASUREMENTS AND INSTRUMENTS 9

Principle and types of analog voltmeters, ammeters, multimeters – Single and three phase wattmeters and energy meters – Magnetic measurements –Instrument transformers – Instruments for measurement of frequency and phase.

UNIT IV MEASUREMENT OF PASSIVE ELEMENTS 9

Resistance measurement: Conventional methods, Wheatstone bridge, sensitivity of wheatstone bridge – Kelvin’s bridges – Kelvin’s double bridge method – Measurement of high resistance – megohm bridge method – Inductance measurement: Maxwell’s inductance bridge – Maxwell’s LC bridge – Hay’s bridge – Anderson’s bridge – Capacitance measurement: De Sauty’s bridge – Schering bridge – Measurement of frequency : Wien’s bridge.

UNIT V BASIC MEASUREMENT METHODS OF NON-ELECTRICAL PARAMETERS 9

Measurement of Pressure: Comparison with known dead weights - Temperature: Thermocouple – pyrometers - Flow: Flow meters – Rotameters – Electromagnetic flow metres – Level: Mechanical, Electrical and optical level indicators - Speed: tachometers – stroboscopic methods, gyroscopes - Acceleration, Humidity:Wet and dry bulb hygrometer – Dunmore and pope cells, conductivity cells.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
2. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2003.

REFERENCES:

1. E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.
2. Alan S. Morris," Measurement & Instrumentation Principles", Elsevier Publications, 2001
3. Arun K. Ghosh, " Introduction to Measurements and Instrumentation", Second Edition, PHI, 2007.

EE9204 DIGITAL SYSTEM DESIGN L T P C
3 1 0 4

AIM

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

OBJECTIVES

- To study various number systems and to simplify the mathematical expressions using Boolean functions – simple problems.
- To study implementation of combinational circuits
- To study the design of various synchronous and asynchronous circuits.
- To expose the students to various memory devices.
- To introduce digital simulation techniques for development of application oriented logic circuit.

UNIT I BOOLEAN ALGEBRA AND COMBINATIONAL CIRCUITS 9+3

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+3

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+3

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

UNIT IV PROGRAMMABLE LOGIC DEVICES, MEMORY AND LOGIC FAMILIES 9+3

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

UNIT V VHDL 9+3

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

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. M. Morris Mano, 'Digital Design', Pearson Education, 2006.
2. John M.Yarbrough, 'Digital Logic, Application & Design', Thomson, 2002.

REFERENCES:

1. Raj Kamal, 'Digital systems-Principles and Design', Pearson education 2nd edition, 2007
2. Charles H.Roth, 'Fundamentals Logic Design', Jaico Publishing, IV edition, 2002.
3. Floyd and Jain, 'Digital Fundamentals', 8th edition, Pearson Education, 2003.
4. John F.Wakerly, 'Digital Design Principles and Practice', 3rd edition, Pearson Education, 2002.
5. Tocci, "Digital Systems: Principles and applications", 8th Edition" Pearson Education.

EC9214 ELECTRONICS LABORATORY L T P C
0 0 3 2

AIM

To provide hands on experience in characterization of electronic devices and development of electronic circuits.

OBJECTIVES

- To obtain the characteristics of electronic devices
- To obtain the characteristics of amplifier circuits
- To simulate electronic circuits using standard software packages

LIST OF EXPERIMENTS

1. PN Junction diode and Rectifier Applications
2. Bipolar Junction transistor - CE, CB, CC characteristics
3. JFET – characteristics and parameter determination
4. UJT & SCR Characteristics & UJT – Controlled SCR
5. Characteristics of DIAC and TRIAC
6. Characteristics of BJT Amplifier frequency response
7. Characteristics of FET amplifier frequency response
8. Characteristics of Class B amplifier – Darlington pair
9. Characteristics of Differential amplifier
10. Class D – Totempole configuration
11. PSPICE modeling of electronic circuits

TOTAL: 45 PERIODS

EE9205 CONTROL AND INSTRUMENTATION LABORATORY

L	T	P	C
0	0	3	2

AIM

To provide a platform for understanding the basic concepts of measurement and control and its application to practical systems.

OBJECTIVES

- To model, analyze and design linear and nonlinear systems.
- To study different measurement techniques and to give exposure in design of a closed loop control system.

LIST OF EXPERIMENTS:

1. Digital simulation of linear systems.
2. Digital simulation of non-linear systems.
3. Study of P, PI and PID controllers and its applications to SISO systems.
4. Study of Lead-Lag compensators and its application to SISO systems.
5. State space analysis of physical systems
6. Stability analysis using conventional techniques.
7. Study of transducers and their characterization (Electrical, and Thermal)
8. Study of transducers and their characterization (Mechanical and flow)
9. Measurement of passive elements using Bridge networks
10. Instrument Transformers – Calibration and Analysis
11. Design of signal conditioning circuits.
12. Closed loop control system design.
13. Measurement systems-Simulation& analysis using LABVIEW

TOTAL: 45 PERIODS

EE9206	**FIELD MEASUREMENT AND COMPUTATION LABORATORY**	**L T P C 0 0 3 2**

AIM

To study about the computational and measurement techniques of electromagnetic fields.

LIST OF EXPERIMENTS:

1. A study of solution techniques for electromagnetic field problem using analytical and numerical methods (FDM and FEM).

Graphical Representation of fields (using MATLAB)

2. Plotting of vector, divergence and curl fields.
3. Plotting of electric field and equipotential lines
4. Plotting of Magnetic fields

Computation of Electric (E) and Magnetic (H) fields (using FEM/FDM packages) for simple configurations

5. Computation of Electric field intensity, voltage distribution and capacitance.
6. Computation of Magnetic field intensity and inductance
7. Calculation of Skin depth

Measurement using field meter

8. Measurement of Electrical Fields
9. Measurement of Magnetic fields
10. Measurement of E and H around practical appliances

TOTAL: 45 PERIODS

EC9261 COMMUNICATION ENGINEERING L T P C
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 theorems, 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 9
(Qualitative only)

Binary communication – entropy, properties, BSC, BEC, source coding : Shannon, Fano, Huffman coding : noiseless coding theorem, BW – SNR trade off, Line codes: NRZ, RZ, AMI, HDBP, ARQ, mBnB codes : Efficiency of transmission, error control codes and applications: convolution& block codes.

UNIT IV MULTIPLE ACCESS TECHNIQUES 9

Spread Spectrum& Multiple (MA)Access techniques : FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages.

UNIT V POWER SYSTEM COMMUNICAITON 9

Satellites, Orbits-Types-frequencies used, link establishment, MA techniques used in satellite communication, earth station; aperture antennas used in satellite – INTELSAT and INSAT: fibers – types: sources, detectors, digital filters, optical link: Basics of power line carrier communications and SCADA

TOTAL : 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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. B.P.Lathi “Modern digital and analog communication systems” Oxford University Press, 1998.

EE9251 TRANSMISSION AND DISTRIBUTION L T P C
3 0 0 3

AIM

To become familiar with the function of different components used in Transmission and Distribution levels of power systems and modeling of these components.

OBJECTIVES

- To develop expression for computation of fundamental parameters of lines.
- To categorize the lines into different classes and develop equivalent circuits for these classes.
- To analyse the voltage distribution in insulator strings and cables and methods to improve the same.

UNIT I INTRODUCTION 9

Structure of electric power system: generation, transmission and distribution; Types of AC and DC distributors – distributed and concentrated loads – interconnection - HVDC and EHV AC transmission

UNIT II TRANSMISSION LINE PARAMETERS 9

Parameters of single and three phase transmission lines with single and double circuits: Resistance, inductance and capacitance of solid, stranded and bundled conductors: Symmetrical and unsymmetrical spacing and transposition; application of self and mutual GMD; skin and proximity effects; interference with neighbouring communication circuits. Typical configuration, conductor types and electrical parameters of 400, 220, 110, 66 and 33 kV lines.

UNIT III MODELLING AND PERFORMANCE OF TRANSMISSION LINES 9

Classification of lines: Short line, medium line and long line; equivalent circuits, attenuation constant, phase constant, surge impedance; transmission efficiency and voltage regulation; real and reactive power flow in lines: Power-angle diagram; surge-impedance loading, shunt and series compensation; Ferranti effect and corona loss.

UNIT IV INSULATORS AND CABLES 9

Insulators: Types, voltage distribution in insulator string and grading, improvement of string efficiency. Underground cables: Introduction-Types of cables, Capacitance of Single-core cable, Grading of cables, Power factor and heating of cables, Capacitance of 3- core belted cable, D.C cables

UNIT V MECHANICAL DESIGN OF LINES AND GROUNDING 9

Mechanical design of transmission line – sag and tension calculations for different weather conditions – Methods of grounding – Peterson coil - Substation layout-Tower Spotting

TOTAL: 45 PERIODS

TEXT BOOKS:

1 C.L.Wadhwa, 'Electrical Power Systems', New Age International Pvt., Ltd., 2007
2. D.P.Kothari , I.J. Nagarath, 'Power System Engineering',Tata McGraw-Hill Publishing Company limited, New Delhi, 2007.

REFERENCES:

1. B.R.Gupta, 'Power System Analysis and Design', S.Chand, New Delhi, 2003.
2. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, 2002.
3. Luces M.Fualkenberry ,Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 1996.
4. Hadi Saadat, 'Power System Analysis,' Tata McGraw Hill Publishing Company', 2003.
5. J.Brian, Hardy and Colin R.Bayliss 'Transmission and Distribution in Electrical Engineering'

EE9252 MICROPROCESSORS AND MICRO CONTROLLERS L T P C
3 0 0 3

AIM

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

OBJECTIVES

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

UNIT I 8085 PROCESSOR 9

8085:Functional block diagram - Signals– Memory interfacing – I/O ports and data transfer concepts – Timing Diagram – Interrupt structure, 8086 Architecture.

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 MICRO CONTROLLER 8051 9

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

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 DC shunt motor- stepper motor control.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', Wiley Eastern Ltd., New Delhi,
2. Muhammad Ali Mazidi & Janice Gilli Mazidi, 'The 8051 Micro Controller and Embedded Systems', Pearson Education, 2007.

REFERENCES:

1. Antonakos, 'The Pentium microprocessor', Pearson Education, 2007
2. Kenneth Ayala, 'The 8051Microcontroller', Thomson, 2005
3. N.K De and P.K Sen, 'Electric Drives', Prentice Hall of India, 2005

EE9253 ELECTRICAL MACHINES – I L T P C
3 1 0 4

AIM

To study the fundamental principles of Electrical machines and the characteristics of D.C Machines and Transformers.

OBJECTIVES

- To study the fundamental principles of Electro-mechanical energy conversion
- To study the machine windings and the MMF pattern of armature and field windings.
- To study the theory, operation and characteristics of DC machines and Transformers.

UNIT I ELECTRO-MECHANICAL ENERGY CONVERSION 6+2

Flux linkage, inductance and energy – time varying and rotational induced emf's – losses – conservation of energy – energy and co energy – force and torque – singly and doubly excited systems – reluctance and mutual torque.

UNIT II TRANSFORMERS 12+4

Construction – principle of operation – ideal transformer – equivalent circuit – testing and efficiency – voltage regulation – auto-transformer – three phase connections – parallel operation of transformers – phase conversion – tap-changing – harmonics – three-winding transformers – applications.

UNIT III BASIC CONCEPTS IN ELECTRICAL MACHINES 9+3

Armature windings: D.C Machine – armature winding (lap and wave connection), field winding – MMF pattern of commutator winding and field winding. A.C Machine (single-phase and three-phase) – concentrated and distributed windings – single – layer and double-layer windings – distribution and pitch factors – MMF pattern for alternating and rotating fields – concept of space phasors – EMF and torque equations.

UNIT IV D.C. MACHINES 12+4

Construction – EMF and torque equation of generator – armature reaction – commutation – methods of excitation – equivalent circuits – characteristics of generators – parallel operation – EMF and torque equation of motor – principle of operation – characteristics of motors.

UNIT V DC MOTORS 6+2

Starting and speed control – testing and efficiency – braking – applications – Permanent Magnet DC Machines.

L: 45 T: 15 TOTAL : 60 PERIODS

TEXT BOOKS:

1. Fitzgerald, A.E.Charles Kingsley Jr.Stephen D.Umans, 'Elecric Machiney', McGraw Hill Book Company, Third Edition 2002.
2. Nagrath, I.J. and Kothari.D.P., Electric Machines', T.M.H. publishing Co. Ltd., New Delhi

REFERENCES:

1. Say M.G "Performance and Design of Alternating Machines", CBS Publishers and Distributors, New Delhi, First Indian Edition, Reprint 1998.
2. Irving L.Kosow, "Electric Machinery and Transformers", Prentice Hall of India Private Ltd., New Delhi, Second Edition, Reprint 2007.
3. Stephen J.Chapman, "Electric Machinery Fundamentals', "McGraw Hill Intl. Edition, New Delhi, 2005.

EE9254 DIGITAL SIGNAL PROCESSING L T P C
3 0 0 3

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 DIGIRAL SIGNAL PROCESSORS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, 2003 / PHI.
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', Tata McGraw Hill, New Delhi, 2001.

REFERENCES:

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. (www.DSPguide.com)
4. B. Venkataramani, M. Bhaskar, 'Digital Signal Processors, Architecture, Programming and Applications', Tata McGraw Hill, New Delhi, 2003.

EE9255 MICROPROCESSOR AND MICROCONTROLLER LABORATORY

L T P C
0 0 3 2

AIM

- To experimentally understand the operation of Intel 8085 microprocessor
- To realize the interfacing concepts with 8251, 8279, 8254.
- To verify and interpret the function of IC 741 by conducting various tests

OBJECTIVES

- To perform simple arithmetic operations using assembly language program.
- To write an assembly language program using the control instructions
- To write an assembly language program to convert Analog input to Digital output and Digital input to Analog output.
- To demonstrate use of control logic instructors.
- To demonstrate the access of parallel port.
- To study various digital & linear integrated circuits used in simple system configuration.
- To test of ICs by using verification of truth table of basic ICs.
- Minimization of functions using K-map implementation and combination Circuit.
- Realizing code conversion of numbers of different bar.
- Design and implementation of 4 bit modulo counters.
- Design and implementation of shift register.
- Design and Realization of Op-Amp application.
- Realization of circuit for digital conversions.
- Demonstration of circuit for communication application

LIST OF EXPERIMENTS

1. Simple arithmetic operations: Multi precision addition / subtraction / multiplication / division.
2. Programming with control instructions: Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers, Rotate instructions, Hex / ASCII / BCD code conversions.
3. Interface Experiments:
   - A/D Interfacing.
   - D/A Interfacing.
   - Traffic light controller.
4. Interface Experiments:
   - Simple experiments using 8251, 8279, 8254.
5. Demonstration of basic instructions with 8051 Micro controller execution, including:
   - Conditional jumps, looping
   - Calling subroutines.
   - Stack parameter testing
6. Parallel port programming with 8051 using port 1 facility:
   - Stepper motor and D / A converter.
7. Study of Basic Digital IC's.
   (Verification of truth table for AND, OR, EXOR, NOT, NOR, NAND, JK FF, RS FF, D FF)
8. Implementation of Boolean Functions, Adder/ Subtractor circuits.
9 Combination Logic: Adder, Subtractor, Code converters, Encoder and Decoder.
10. Sequential Logic: Study of Flip-Flop, Counters (synchronous and asynchronous), Shift Registers
11. Op-Amp Linear Application: Comparator, Differentiator, Integrator, Adder, Subtractor. Op-amp Non Linear Application: Clipper, Clamper, Peak detector, Timer IC application, VCO and PLL.

TOTAL: 45 PERIODS

REFERENCES:

1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Applications', Wiley Eastern Ltd., New Delhi, 1995.
2. Myke Predko, 'Programming and Customizing the 8051 Microcontroller', Tata McGraw Hill, 1999.
3. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003

EE9256 ELECTRICAL MACHINES LABORATORY – I L T P C
0 0 3 2

AIM

To provide experimental skill in the operation of DC machines and Transformers.

OBJECTIVES

- To experimentally verify the principle of operation, performance and characteristics of DC Motors, DC Generators and Transformers
- To study the operation of DC motor starters, different connections of Transformers.

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of a separately excited DC Generator
2. Open circuit and load characteristics of DC shunt Generator
3. Load characteristics of DC compound motor
4. Load test on DC shunt motor.
5. Load test on DC series motor.
6. Speed control of DC shunt motor.
7. Swinburne's test
8. Study of DC motor starters.
9. Open circuit and short circuit test on single-phase transformer
10. Separation of no load losses in a single phase transformer
11. Sumpner's test
12. Three phase connection
13. Scott connection

TOTAL: 45 PERIODS

EE9301 **POWER ELECTRONICS** **L T P C**
3 1 0 4

AIM

To understand the various applications of electronic devices for conversion, control and conditioning of the electrical power.

OBJECTIVES

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and Matrix converters.

UNIT I POWER SEMI-CONDUCTOR DEVICES 12

Overview of switching devices – Driver and snubber circuit of SCR TRIAC, GTO, IGBT, MOSFET – Computer simulation of PE circuits.

UNIT II PHASE CONTROLLED CONVERTERS 12

2 pulse / 3 pulse and 6 pulse converters – Effect of source inductance – performance parameters – Reactive power control of converters – Dual converters.

UNIT III DC TO DC CONVERTERS 12

Stepdown and stepup chopper – Forced commutation techniques – Time ratio control and current limit control – Switching mode regulators Buck, Boost, Buck-Boost – concept of resonant switching.

UNIT IV INVERTERS 12

Single phase and three phase [120^o & 180^o mode] inverters – PWM techniques – Sinusoidal PWM, Modified sinusoidal PWM and multiple PWM – Voltage and harmonic control – Series resonant inverter – current source inverter.

UNIT V AC TO AC CONVERTERS 12

Single phase AC voltage controllers – Multistage sequence control – single phase and three phase cycloconverters – power factor control – Matrix converters.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, 3rd Edition, New Delhi, 2004.
2. Ned Mohan, T.M.Undeland, W.P.Robbins, "Power Electronics: Converters, applications and design", John wiley and Sons, 3rd Edition, 2006.

REFERENCES:

1. Cyril.W.Lander, "Power Electronics", McGraw Hill International, Third Edition, 1993.
2. P.S.Bimbra "Power Electronics", Khanna Publishers, third Edition 2003.
3. Philip T.Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.

EE9302 POWER SYSTEM ANALYSIS L T P C
3 1 0 4

AIM

To become familiar with the modeling of various power system components and different methods of analysis for power system planning and operation.

OBJECTIVES

- To model steady-state operation of large-scale power systems and to solve the power flow problems using efficient numerical methods suitable for computer simulation.
- To model and analyse power systems under abnormal (fault) conditions.
- To model and analyse the dynamics of power system for small-signal and large signal disturbances and o design the systems for enhancing stability.

UNIT I INTRODUCTION 12

Overview of Power System Analysis: Importance of system planning and operational analysis; Distinction between steady state, quasi steady state and transient analysis; Per phase analysis of symmetrical three phase system, single line diagram, per unit representation; different models for generator, load and transmission lines based on the analysis of interest – π equivalent circuit of transformer with off nominal-tap ratio.

UNIT II BASICS OF ANALYSIS AND COMPONENT MODELLING 12

Primitive network and its matrices, bus admittance matrix formation by inspection method and singularity transformation method, bus impedance matrix formation by L-U factorisation of bus admittance matrix and by building algorithm. Symmetrical component transformation, sequence impedances and sequence networks.

UNIT III POWER FLOW ANALYSIS 12

Importance of power flow analysis in planning and operation of power systems; Power flow problem: Description of the problem, classification of buses into P-Q buses, P-V (voltage-controlled) buses and slack bus. Power flow equations and solution: Development of power flow model in complex variable form, Iterative solution using Gauss-Seidel and Newton-Raphson methods including Q-limit check for voltage-controlled buses, flow chart- numerical examples.

UNIT IV FAULT ANALYSIS 12

Symmetrical short circuits: Thevenin's theorem and applications, short circuit analysis - numerical examples. Short circuit capacity - circuit breaker selection. Unsymmetrical short circuits: Derivation of fault current for LG, LL, LLG short circuits and development of interconnection of sequence networks.

UNIT V STABILITY ANALYSIS 12

Description of power system stability problem; importance of stability analysis in power system planning and operation; classification of power system stability. Single Machine Infinite Bus (SMIB) system: Development of swing equation; power-angle equation; Equal Area Criterion; determination of critical clearing angle and time; algorithm for numerical solution of swing equation using modified Euler method; usage of numerical algorithm for determination of critical clearing time by trial and error – digital simulation.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002.
2. John J. Grainger and W.D. Stevenson Jr., 'Power System Analysis', Tata McGraw Hill Publishing Company Ltd., New Delhi,2003**.**
3. D.P.Kothari , I.J. Nagarath, 'Power System Engineering',Tata McGraw-Hill Publishing Company Ltd., NewDelhi, 2007

REFERENCES:

1. P. Kundur, 'Power System Stability and Control, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1994.
2. I.J. Nagrath and D.P. Kothari, 'Modern Power System Analysis', Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1990.
3. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing company Limited, New Delhi, Second Edition, 2003.

EE9303 LINEAR INTEGRATED CIRCUITS L T P C
3 1 0 4

AIM

To introduce the concepts of operational amplifiers and other linear ICs

OBJECTIVES

- To study the characteristics of OPAMP and to introduce IC fabrication procedure.
- To study applications of OPAMPs
- To introduce the design of OPAMP based application circuits.
- To study special OPAMP circuits
- To study the applications of OPAMP circuits.

UNIT I CHARACTERISTICS OF OPAMP 12

Fundamentals of monolithic ICs technology – realization –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;

UNIT II APPLICATIONS OF OPAMP 12

Summer, differentiator and integrator – Voltage comparators - Instrumentation amplifier, V/I & I/V converters, 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 III DESIGN WITH OPAMP 12

First and second order active filters –Oscillators — Waveform generator - Schmitt trigger – multivibrator.

UNIT IV SPECIAL ICs 12

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 OF ICs 12

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

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS

1. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI.
2. David A Bell, Opamp and linear ICs, second edition, practice hall of India.

REFERENCES

1. Robert F Coughlin, Fredrick, F. Driscold,'Opamp and linear ICs, Pearson education, 4th edition, 2002
2. D. Roy Choudhery, Sheil B. Jeni, 'Linear Integrated Circuits, second edition, New Age publishers, 2003.
3. Joseph J cerr, 'Linear Integrated circuits', Elsevier, 1996
4. David L Tenel, "Opamps – design, applications and trouble shooting", Elsevier 1996

EE9304 ELECTRICAL MACHINES – II L T P C
3 1 0 4

AIM

To study the theory, operation and performance of AC machines.

OBJECTIVES

- To study the theory and performance characteristics of Induction machines.
- To study the theory and performance characteristics of Synchronous machines.
- To study theory of operation and performance characteristics of fractional horse power motors.

UNIT I INDUCTION MACHINES: THEORY 12

Construction – types – principle of operation of motor – emf, torque and power flow equations – torque and speed curves – double cage motor and equivalent circuit – synchronous induction motor – induction generator.

UNIT II INDUCTION MACHINES: PERFORMANCE 12

Induction motor testing, equivalent circuit and circle diagram – losses and efficiency – performance characteristics – harmonics, cogging and crawling – starting methods – speed control methods – braking – temperature rise and insulation – energy efficient motors.

UNIT III SYNCHRONOUS MACHINES: THEORY 12

Construction – types – generator and motor action – theory of cylindrical rotor machines – armature reaction and synchronous reactance – emf and power equation – synchronization – synchronizing power and parallel operation – two reaction theory of salient pole machines and determination of direct axis and quadrature axis reactance.

UNIT IV SYNCHRONOUS MACHINE: PERFORMANCE 12

Pre-determination of voltage regulation – synchronous machine on infinite bus bars – V curves and inverted V-curves of motor and generator – steady state operating characteristics – hunting – short-circuit transients – synchronous condenser action.

UNIT V FRACTIONAL HORSE POWER MOTORS 12

Single-phase induction motor – double revolving field theory – testing, equivalent circuit and performance analysis – starting methods – universal motor.

L=45 T=15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Say M.G, "Performance and Design of Alternating Machines' CBS Publishers and Distributors, New Delhi, First Indian Edition, Reprint 1998.
2. Nagarth I.J. and Kothari D.P., Electric Machines, Tata McGraw Hill, New Delhi, Edition 2004.

REFERENCES:

1. Fitzgerald A.E., Charles Kingsley Jr., and Stephen D.Umans, "Electric Machinery, "Tata McGraw Hill, New Delhi, Edition 2002.
2. Irving L.Kosow, "Electric Machinery and Transformers" Prentice Hall of India Private Limited, New Delhi., Second Edition, Reprint 2007.
3. Stephan J.Chapman, "Electric Machinery Fundamentals', McGraw hill International Edition, New Delhi, 2005.

EE9305 DATA STRUCTURES AND ALGORITHMS L T P C
3 0 0 3

AIM

The aim of this course is to provide an introduction to computer algorithms and data structures, with an emphasis on foundational material.

OBJECTIVES

At the end of the course students should

- Have a good understanding of the fundamental data structures used in computer science
- Have a good understanding of how several fundamental algorithms work, particularly those concerned with sorting, searching and graph manipulation
- Be able to analyze the space and time efficiency of most algorithms
- Be able to design new algorithms or modify existing ones for new applications and reason about the efficiency of the result

UNIT I INTRODUCTION AND BASIC DATA STRUCTURES 9

Problem solving Techniques and Examples - Abstract Data Type (ADT) - The List ADT - Arrays - Stacks and Queues: Implementation and Applications.

UNIT II ADVANCED DATA STRUCTURES 9

Trees: Preliminaries - Binary Tree - Tree Traversals - Binary Search Trees - AVL Trees.

UNIT III SORTING AND HASHING 9

Sorting by Selection - Sorting by Insertion - Sorting by Exchange - Sorting by Diminishing Increment - Heap Sort - Heaps - Maintaining the Heap Property - Building a Heap - Heap Sort Algorithm - Quick Sort - Description - Performance of quick sort - Analysis of Quick Sort.. Hashing - General Idea - Hash Functions - Separate Chaining - Open Addressing - Rehashing - Extendible Hashing.

UNIT IV ALGORITHM DESIGN TECHNIQUES 9

The role of Algorithms in computing - Getting Started - Growth of functions. Divide and Conquer - Dynamic Programming - Greedy Algorithm - Backtracking - Branch and Bound - Randomized Algorithms

UNIT V GRAPHS ALGORITHMS 9

Elementary Graph Algorithms - Minimum Spanning Trees - Single-source Shortest Paths - All Pairs Shortest Paths.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M A Weiss, "Data Structures and Algorithm Analysis in C++", 3rd Edition, Pearson Education, 2007.
2. Thomas H Cormen, Charles E Leiserson and Ronald L Rivest, "Introduction to Algorithms", 2nd Edition, Prentice Hall of India, 2002.

REFERENCES:

1. R G Dromey, "How to Solve it by Computers", Pearson Education Asia, 2005.
2. Robert L Kruse, Clovis L Tando and Bruce P Leung, "Data Structures and Program Design in C", 2nd Edition, Prentice Hall of India.
3. Jean Paul Trembley, Paul G Sorenson, "An Introduction to Data Structures with Applications", 2nd Edition, Tata McGraw Hill, 2007.

EE9306 PROTECTION AND SWITCHGEAR L T P C
3 0 0 3

AIM

To study the various faults and protection schemes in power systems.

OBJECTIVES

- To discuss the need for the protection and various protection schemes.
- To study relays characteristics
- To Study apparatus protection
- To understand the method of circuit breaking, arcing phenomena – various arc theories -capacitive and inductive breaking.
- To understand the working of different types of circuit breakers.

UNIT I INTRODUCTION 9

Principles and need for protective schemes – nature and causes of faults – types of faults – fault current calculation using symmetrical components – earthing – Zones of protection and essential qualities of protection – Protection schemes – CTs and PTs and their applications.

UNIT II PROTECTIVE RELAYS 9

Operating principles of relays, the universal relay, torque equation, relay characteristics, electromagnetic relays – over current, directional, distance and differential relays, negative sequence relays, static relays - amplitude and phase comparators, Introduction to numerical relays.

UNIT III APPARATUS PROTECTION 9

Apparatus protection – transformer, generator, motor – protection of bus bars and transmission lines.

UNIT IV THEORY OF CIRCUIT INTERRUPTION 9

Physics of arc phenomena and arc interruption. Restriking voltage and recovery voltage, rate of rise of recovery voltage, resistance switching, current chopping, interruption of capacitive current, DC circuit breaking.

UNIT V CIRCUIT BREAKERS 9

Types of Circuit Breakers – Air blast, air break, oil, SF_6 and Vacuum circuit breakers – Comparison of different circuit breakers.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. B.Ravindranath and N.Chander, “Power System Protection and Switchgear”, New Age International (P) Ltd., 1st Edition 1997 (Reprint 2006)
2. Badri Ram , B.H.Vishwakarma, “Power System Protection and Switchgear”, Tata McGraw-Hill, 2001.

REFERENCES:

1. Sunil S.Rao “Switchgear and Protection”, Khanna publishers, New Delhi, 1986.
2. C.L.Wadhwa, “Electrical Power Systems”, New Age International (P) Ltd., 4th Edition 2005.
3. Y.G.Paithankar and S.R.Bhide, “Fundamentals of power system protection”, Prentice Hall of India Pvt. Ltd., New Delhi – 2003.
4. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarti, “A Text Book on Power System Engineering”, Dhanpat Rai & Co., 1998.
5. A.T.Johns, S.K.Salman, “Digital protection for power systems” Peter Peregrinus, IEE 1995.

EE9307 ELECTRICAL MACHINES LABORATORY – II L T P C
0 0 3 2

AIM

To study the performance characteristics of synchronous machines and induction machines

OBJECTIVES

- To experimentally verify the principle of operation, performance and characteristics of Synchronous machines and Induction machines using load tests and pre-determination tests.
- To study three phase induction motor starters.
- To study the operation and performance of variable reluctance synchronous machine and permanent magnet synchronous machines.

LIST OF EXPERIMENTS:

1. Load characteristics of three-phase induction motor
2. Load test on synchronous induction motor
3. Equivalent circuit of single – phase induction motor
4. Load test on single – phase induction motor.
5. Variable Reluctance synchronous motor
6. Slip test – Determination of X_d and X_q
7. V& Inverted V Curves of synchronous motor
8. Load characteristics of induction generator
9. Synchronization of transformers.
10. Characteristics of Permanent Magnet / Synchronous Machines (PMSM)
11. Characteristics of Permanent Magnet / Brushless DC machines (PMBL)

TOTAL: 45 PERIODS

EE9308 POWER ELECTRONICS LABORATORY L T P C
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:

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
11. AC Voltage Controller
12. Cyclo-converter

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, 3rd Edition, New Delhi, 2004.
2. Ned Mohan, T.M.Undeland, W.P.Robbins, "Power Electronics: Converters, applications and design", John wiley and Sons, 3rd Edition, 2006.
3. O.P Aroa, “Power Electronics Laboratory” Narosa Publications 2007, Theory, Practicals Organization.

GE9371	COMMUNICATION SKILLS AND SOFT SKILLS (LABORATORY COURSE) FIFTH / SIXTH SEMESTER (ELECTIVE COURSE)	L T P C 0 0 2 1

AIM

To enhance the overall capability of students and to equip them with the necessary Communication Skills and Soft Skills that would help them excel 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 jobs.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

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

1. Resume / Report Preparation / Letter Writing: (2)

Letter writing – Job application with Resume - Project report - Email etiquette.

2. Presentation skills: (1)

Elements of effective presentation – Structure of presentation - Presentation tools – Body language.

3. Soft Skills: (1)

Time management – Stress management – Assertiveness – Negotiation strategies.

1. Group Discussion: (1)

Group discussion as part of selection process, Structure of group discussion – Strategies in group discussion – Mock group discussions.

2. Interview Skills: (1)

Kinds of interviews – Interview techniques – Corporate culture – Mock interviews. (Career Lab Software may be used for this section).

Note: Career Lab software may be used to learn the skills, to be applied in the practice session.

B. Practice session (24 periods)

Resume / Report Preparation / Letter writing: Students prepare their own resume and report. **(4)**

1. **Presentation Skills:** Students make presentations on given topics. **(8)**
2. **Group Discussion**: Students participate in group discussions. **(6)**
3. **Interview Skills**: Students participate in Mock Interviews **(6)**

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. David Evans, **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.

EE9351 EMBEDDED SYSTEM DESIGN L T P C
3 1 0 4

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 12

Introduction to embedded real time systems – The build process for embedded systems – Types of memory – Memory management methods.

UNIT II EMBEDDED SYSTEM ORGANIZATION 12

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 12

Intel I/O instructions – Synchronization - Transfer rate, latency; interrupt driven input and output - Nonmaskable 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 12

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 12

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

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Rajkamal, 'Embedded system-Architecture, Programming, Design', Tatamcgraw Hill , 2003.
2. Daniel W. Lewis ,'Fundamentals of Embedded Software', Prentice Hall of India,2004.

REFERENCES:

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.

EE9352 HIGH VOLTAGE ENGINEERING L T P C
3 0 0 3

AIM

To learn about the high voltage breakdown mechanism, generation, measurement and testing.

OBJECTIVES

To understand

- the various types of over voltages in power system and protection schemes.
- the nature of breakdown mechanism in solid, liquid and gaseous dielectrics
- the generation of over voltages in laboratories
- the measurement of over voltages.
- the testing of power apparatus and insulation coordination

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and their effects on power system – Lightning, switching and temporary over voltages – protection against over voltages - Insulation coordination – BIL.

UNIT II ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS 9

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 9

Generation of high DC, AC, impulse voltages and currents, tripping and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9

Measurement of high voltages and high currents, digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M.S.Naidu and V.Kamaraju, “High Voltage Engineering’ Tata McGraw Hill, 3rd Edition, 2004
2. E.Kuffel and W.S. Zaengl, J.Kuffel “High voltage Engineering fundamentals”, Newness 2nd Edition 2000.

REFERENCES:

1. L.L.Alston, “High Voltage Technology”, Oxford University Press, First Indian Edition 2006.
2. C.L.Wadhwa, “High voltage Engineering” ,New Age International, Second Edition
3. Mazen Abdel – Salam, Hussein Anis, Ahdab A-Morshed, Roshday Radwan “High Voltage Engineering” – Theory & Practice”, Marcel Dekker, Inc., 2000.
4. Ravindra Arora, Wolfgang Mosh, “High Voltage Insulation Engineering”, New Age International Publishers, 1995

EE9353 POWER SYSTEM OPERATION AND CONTROL L T P C
3 0 0 3

AIM

To become familiar with the preparatory work necessary for meeting the next day's power system operation and the various control actions to be implemented on the system to meet the minute-to-minute variation of system load.

OBJECTIVES

- To get an overview of system operation and control.
- To understand & model power-frequency dynamics and to design power-frequency controller.
- To understand & model reactive power-voltage interaction and different methods of control for maintaining voltage profile against varying system load.

UNIT I INTRODUCTION 6

System load variation: System load characteristics, load curves - daily, weekly and annual, load- duration curve, load factor, diversity factor. Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves. Overview of system operation: Load forecasting, unit commitment, load dispatching. Overview of system control: Governor control, LFC, EDC, AVR, system voltage control, security control.

UNIT II REAL POWER - FREQUENCY CONTROL 12

Fundamentals of speed governing mechanism and modeling: Speed-load characteristics – Load sharing between two synchronous machines in parallel; concept of control area, LFC control of a single-area system: Static and dynamic analysis of uncontrolled and controlled cases, Economic Dispatch Control. Multi-area systems: Two-area system modeling; static analysis, uncontrolled case; tie line with frequency bias control of two-area system derivation, state variable model.

UNIT III REACTIVE POWER–VOLTAGE 9

Typical excitation system, modeling, static and dynamic analysis, stability compensation; generation and absorption of reactive power: Relation between voltage, power and reactive power at a node; methods of voltage control - shunt reactors – shunt capacitors – series capacitors – synchronous condensers – static var systems- Tap-changing transformer - System level voltage control.

UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH 9

Statement of Unit Commitment (UC) problem; constraints in UC: spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints; UC solution methods: Priority-list method, forward dynamic programming approach, Incremental cost curve, co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. Base point and participation factors. Economic dispatch controller added to LFC control.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Energy control centre: Functions – Monitoring, data acquisition and control. System hardware configuration – SCADA and introduction to EMS functions: Network topology determination, 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. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Ltd, New Delhi, Second Edition, 2003.
2. Allen.J.Wood and Bruce F.Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2003.

REFERENCES:

1. D.P. Kothari and I.J. Nagrath, 'Modern Power System Analysis', Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
2. L.L. Grigsby, 'The Electric Power Engineering, Hand Book', CRC Press & IEEE Press, 2001.
3. P. Kundur, 'Power System Stability & Control', Tata McGraw Hill Publishing Company Ltd., USA, 1994.

EE9354	DATA COMMUNICATION AND COMPUTER NETWORKS	L T P C 3 0 0 3

AIM

To understand the basic concepts of data communication and the design concept of different layers of computer networks.

OBJECTIVES

To provide a clear understanding of

- The framework of a computer network and reference models.
- The functionalities of various layers of the network.
- Error detection and correction methods.
- Routing and routing algorithms.
- Important programs running in the application layer.

UNIT I INTRODUCTION AND DATA LINK LAYER 12

Network Hardware - Reference Models: OSI, TCP/IP - Network Standardization. Public Switched Telephone Network (PSTN). Data Link Layer: Design Issues - Error Detection and Correction - Elementary Data Link Protocols - Sliding Window Protocols - HDLC. Medium Access Control Sublayer: Channel Allocation Problem - Multiple Access Protocols - Ethernet - Wireless LANs - Data Link Layer Switching.

UNIT II NETWORK LAYER 9

Simple Internetworking - IP - ARP - DHCP - ICMP. Network Layer: Design Issues - Routing Algorithms - Congestion Control Algorithms - Internetworking - IP Protocol - IP Addresses - Mobile IP - IPv6.

UNIT III TRANSPORT LAYER 9

Transport Layer: Transport Service - Elements of Transport Protocols - Internet Transport Protocols: UDP - TCP.

UNIT IV APPLICATION LAYER 6

Application Layer: Domain Name System - Electronic Mail - Telnet - FTP - SNMP - World Wide Web - Web Services - Multimedia Applications.

UNIT V NETWORK SECURITY 9

Cryptography - Symmetric-key Algorithms - Public-key Algorithms - Digital Signatures - Management of Public Keys - Communication Security - Selected Authentication protocols - e-mail Security - Web Security - Social Issues.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Andrew S Tanenbaum, 'Computer Networks', Pearson Education, 2007.
2. Behrouz A Forouzan, 'Data Communication and Networking', 2nd Edition, Tata McGraw Hill, 2006.

REFERENCES:

1. Larry L Peterson and Bruce S Davie, "Computer Networks", Edition 4, Elsevier Publications, 2007.
2. Prakash C Gupta, 'Data Communication and Computer Networks', PHI, 2006.
3. William Stallings, 'Data and Computer Communication', 8th Edition, Pearson Education, 2003 / PHI, 2007.
4. Wayne Tomasi, "Introduction to Data Communication and Networking",First Edition, Pearson Education, 2007.

EE9355 DESIGN OF ELECTRICAL APPARATUS L T P C
3 1 0 4

AIM

To provide knowledge on the design aspects of Electrical machines.

OBJECTIVES

- Have a good understanding on the design and applications of DC &AC machines
- To introduce the basic design concepts and cooling arrangement of transformers.
- To introduce computer aided machine design.

UNIT I FUNDAMENTALS OF ELECTRICAL MACHINE DESIGN 12

Standard specification of frame size, conductors and insulation - Magnetization and loss curves – Choice of specific loadings- Heating and cooling of electrical machines.

UNIT II D.C MACHINES 12

Construction details – output equation – main dimensions- Choice of specific loadings – choice of number of poles- armature design – design of field poles and field coils – design of commutator and brushes.

UNIT III TRANSFORMERS 12

Construction details of core and shell type transformers – output rating of single phase and three phase transformers – optimum design of transformers - design of yoke, core and winding for core and shell type transformers-equivalent circuit parameters from design data- Design of tank and cooling tubes of transformers.

UNIT IV A.C. MACHINES 12

Construction details of A.C. machines – output equation – main dimensions- Choice of specific loadings –design of stator – design of squirrel cage and slip ring rotor- equivalent circuit parameter from design data – Short circuit ratio- design of rotor of cylindrical pole and salient pole machines.

UNIT V COMPUTER AIDED DESIGN 12

Need for computer aided design – Analysis method – Synthesis method - Introduction to analysis of Electric machine parameters using FEM.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. A.K.Sawhney , 'A course in Electrical Machine Design' , Dhanpat Rai and sons, New Delhi , 1984.
2. SK Sen, 'Principles of Electrical Machine Design with Computer Programme',, Oxford and IBH publishing Co. Pvt Ltd., New Delhi, 1987

REFERENCES:

1. R.K Agarwal, 'Principles of Electrical Machine Design' , S.K.Kataria sons , New Delhi, 2002
2. V.N Mittle and A.Mittle, 'Design of Electrical Machines',Standard Publications and Distributors , Delhi , 2002.
3. Sheppard J.Salen, "FEA of Electrical Machines, Springer International Edition, First Indian reprint, 2007.
4. M.G.Say "Performance and Design of AC machines" CBS Publishers and distributors, New Delhi, first Indian Edition, Reprint 1998.
5. A.E. Clayton and N.H.Hancook "Performance and design of DC machines" ELBS: Pitman edition, 1962.

EE9357 POWER SYSTEM SIMULATION LABORATORY L T P C
0 0 3 2

AIM

To become proficient in the usage of the software to tackle real life problems encountered in the areas of power system planning and operation.

OBJECTIVES

- To understand, the basic aspects of steady state analysis of power systems that are required for effective planning and operation of power systems.
- To understand the basics of economic operation of power system.
- To become familiar with the modeling and analysis of load-frequency and tie-line flow dynamics of a power system with load-frequency controller (LFC) under different control modes.

LIST OF EXPERIMENTS

1. Computation of Parameters and Modeling 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 Multi-machine 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

EE9358	**HIGH VOLTAGE LABORATORY**	**L T P C**
		0 0 3 2

AIM

To train the students in HV Laboratory practice.

OBJECTIVES

- To understand various generation and measurement of HVDC / AC and Impulse.
- To train the students on non-disctructive testing, normal capacitance and loss tangent and partial discharge
- To understand breakdown phenomena in solid, liquid and gascious insulations
- To train the students in simulation techniques and computational techniques for design of high voltage apparatus.

LIST OF EXPERIMENTS

1. Generation and measurement of High voltage DC using Cocroft Walton circuit .
2. Generation and measurement of High voltage AC using cascaded transformer.
3. Generation and measurement of lightning impulse voltage using Marx circuit
4. Measurement of capacitance and loss tangent of high voltage equipment.
5. Measurement of power harmonics using energy analyzer.
6. Testing of High voltage insulators / bushings.
7. Study of breakdown phenomena in air, oil and solid dielectrics
8. Simulation and analysis of Cocroft-Walton circuit using circuit simulation package.
9. Simulation and analysis of Marx generator using circuit simulation package.
10. Electric field computation in High voltage apparatus by numerical method(FEM).

TOTAL: 45 PERIODS

EE9359 **TECHNICAL SEMINAR** **L T P C**

0 0 2 1

OBJECTIVES

- During the seminar session each student is expected to prepare and present a topic on Electrical and Electronics Engineering, 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. Outside experts also may be invited to deliver state of the art technological innovations.
- Students are encouraged to use various teaching aids such as overhead projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

TOTAL: 30 PERIODS

EE9401 **SOLID STATE DRIVES** **L T P C**

3 0 0 3

AIM

To study and understand the operation of electrical machines controlled by a power electronic converter and to introduce the controller design concepts.

OBJECTIVES

- To understand steady state operation and transient dynamics of a motor load system.
- To study and analyze the operation of the converter / chopper fed dc drive, both qualitatively and quantitatively.
- To study and understand the operation and performance of AC motor drives.
- To analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

UNIT I DRIVE CHARACTERISTICS 9

Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics.

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE 9

Steady state analysis of the single and three phase converter fed separately excited DC motor drive – continuous and discontinuous conduction – Time ratio and current limit control – 4 quadrant operation of converter / chopper fed drive.

UNIT III INDUCTION MOTOR DRIVES 9

Stator voltage control – energy efficient drive – v/f control – constant air gap flux – field weakening mode – voltage / current fed inverter – closed loop control.

UNIT IV SYNCHRONOUS MOTOR DRIVES 9

V/f control and self control of synchronous motor: Margin angle control and power factor control – permanent magnet synchronous motor.

UNIT V 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.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gopal K.Dubey, "Fundamentals of Electrical Drives", Narosa Publishing House, 1992.
2. Bimal K.Bose. "Modern Power Electronics and AC Drives", Pearson Education, 2002.

REFERENCES:

1. S.K.Pillai, "A First course on Electrical Drives", Wiley Eastern Limited, 1993.
2. Murphy J.M.D and Turnbull, "Thyristor Control of AC Motor", Pergamon Press, Oxford 1988.
3. Gopal K.Dubey, "Power semiconductor controlled Drives:, Prentice Hall Inc., New Jersey, 1989.
4. R.Krishnan, "Electric Motor & Drives: Modeling, Analysis and Control", Prentice hall of India, 2001.

EE9402 UTILISATION AND CONSERVATION OF ELECTRICAL ENERGY

L	T	P	C
3	0	0	3

UNIT I ELECTRIC DRIVES AND TRACTION 9

Fundamentals of Electric drive – choice of an Electric Motor – Application of motors for particular services. Traction Motors – Characteristic features of Traction motor – Systems of railway electrification – Electric Braking – Train movement and energy consumption – Traction Motor control – Track equipment and collection gear.

UNIT II ILLUMINATION 9

Introduction – Definition and meaning of terms used in illumination Engineering – Classification of light sources. Incandescent lamps, sodium vapour lamps, mercury vapour lamps, fluorescent lamps – Design of illumination systems – Indoor lighting schemes – factory lighting halls – outdoor lighting schemes – flood lighting – street lighting – Energy saving lamps.

UNIT III HEATING AND WELDING 9

Introduction – advantages of Electric heating – Modes of heat transfer – Methods of electric heating – Resistance heating – Arc furnaces – Induction heating – Dielectric heating. Electric welding – Types – Resistance welding – Arc welding – Radiation welding – Requirements of good weld – Preparation of work – Electrodes – Power supply for arc welding.

UNIT IV REFRIGERATION AND AIR CONDITIONING 9

Introduction – Refrigeration cycle – Refrigeration system – Types of refrigerants – Domestic refrigerator – Water coolers – Air conditioning systems – Air conditioning cycle – Classification of air conditioning systems – Central system – Unitary systems – Load estimation – Heating of building.

UNIT V ECONOMICS OF ELECTRICAL ENERGY UTILIZATION 9

Economics of Electric power supply – General rule for charging the energy – Economical cross section of a conductor – Ratings of a motor – temperature rise in a motor – power factor improvement – methods of reducing power factor occurrence – Economic choice of equipment – energy management – energy auditing – power quality – effect on conservation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dr.N.V.Suryanarayana, Utilisation of Electric power, Wiley Eastern Limited, New Age International Limited, 1993.
2. J.B.Gupta, Utilisation Electric power and Electric Traction, S.K.Kataria and Sons, 2000.

REFERENCES:

1. R.K.Rajput, Utilisation of Electrical Power, Laxmi publications (P) Ltd., 2007.
2. H.Partab, Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co., New Delhi – 2004.
3. C.L.Wadhwa, "Generation, Distribution and Utilisation of Electrical Energy", New Age International Pvt. Ltd., 2003.

GE9261 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
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 them sensitive to the environment problems in every professional endeavour that they participates.

OBJECTIVE:

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

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity –

biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

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

UNIT III NATURAL RESOURCES 10

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

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

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 – role of non-governmental organization- 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 – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

EE9403 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.

EE9404 DESIGN LABORATORY L T P C
0 0 3 2

AIM

To train the students in providing complete design solution in electrical drives and control.

OBJECTIVES

To introduce the concept of dynamic simulation and design of controllers for

- DC and AC machines
- Power circuits
- Uninterrupted Power Supply (UPS)

using appropriate software packages.

LIST OF EXPERIMENTS:

1. Design of Speed control of DC machines
2. Design of Speed control of Induction machines
3. Design of Speed control of permanent magnet synchronous machines
4. Design of power converters
5. Design of inverters
6. Design of DC machine

7. Design of Reluctance machine
8. Design of synchronous machine
9. Design of induction machines
10. Design of UPS
11. Design of Transformer

TOTAL: 45 PERIODS

MA9262	NUMERICAL METHODS	L T P C 3 1 0 4

AIM

This course gives a complete procedure for solving numerically different kinds of problems occurring in engineering and technology.

OBJECTIVES

The students would be acquainted with the basic concepts of numerical methods and their applications.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 13

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton-Raphson method- Solution of linear system of equations - Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method - Eigenvalues of a matrix by Power method and by Jacobi's method.

UNIT II INTERPOLATION AND APPROXIMATION 11

Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step-methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Multi-step methods - Milne's and Adams-Bashforth predictor-corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference methods for solving two-point linear boundary value problems. Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank Nicholson) methods - One dimensional wave equation by explicit method.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.
2. Sankara Rao, K. "Numerical methods for Scientists and Engineers', 3rd Edition Prentice Hall of India Private Ltd., New Delhi, 2007.

REFERENCES:

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.
2. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.
3. Brian Bradie, "A friendly introduction to Numerical analysis", Pearson Education Asia, New Delhi, 2007.

MA9265 DISCRETE MATHEMATICS L T P C
3 1 0 4

AIM

To extend student's Logical and Mathematical maturity and ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.

OBJECTIVES

At the end of the course, students would

- Have knowledge of the concepts needed to test the logic of a program.
- Have an understanding in identifying structures on many levels.
- Be aware of a class of functions which transform a finite set into another finite set which relates to input output functions in computer science.
- Be aware of the counting principles
- Be exposed to concepts and properties of algebraic structures such as semi groups, monoids and groups.

UNIT I LOGIC AND PROOFS 12

Propositional Logic – Propositional equivalences-Predicates and quantifiers-Nested Quantifiers-Rules of inference-introduction to Proofs-Proof Methods and strategy

UNIT II COMBINATORICS 12

Mathematical induction-Strong induction and well ordering-.The basics of counting-The pigeonhole principle –Permutations and combinations-Recurrence relations-Solving Linear recurrence relations-generating functions-inclusion and exclusion and applications.

UNIT III GRAPHS 12

Graphs and graph models-Graph terminology and special types of graphs-Representing graphs and graph isomorphism - connectivity-Euler and Hamilton paths

UNIT IV ALGEBRAIC STRUCTURES 12

Algebraic systems-Semi groups and monoids-Groups-Subgroups and homomorphisms-Cosets and Lagrange's theorem- Ring & Fields (Definitions and examples)

UNIT V LATTICES AND BOOLEAN ALGEBRA 12

Partial ordering-Posets-Lattices as Posets- Properties of lattices-Lattices as Algebraic systems –Sub lattices –direct product and Homomorphism-Some Special lattices-Boolean Algebra.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 6th Edition, Special Indian edition , Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2007. (For the units 1 to 3 , Sections 1.1 to 1.7 , 4.1 &4.2, 5.1 to 5.3, 6.1 ,6.2, 6.4 to 6.6, 8.1 to 8.5)
2. Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 30th Re-print 2007.(For units 4 &5 , Sections 2-3.8&2-3.9,3-1 ,3-2& 3-5 4-1&4-2)

REFERENCES:

1. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fourth Edition, Pearson Education Asia, Delhi, 2002.
2. Thomas Koshy,"Discrete Mathematics with Applications", Elsevier Publications, 2006.
3. Seymour Lipschutz and Mark Lipson," Discrete Mathematics", Schaum's Outlines, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2007,Second edition, Fifth reprint, 2007

MA9267 STATISTICS AND LINEAR PROGRAMMING L T P C
3 1 0 4

AIM

To provide the required skill to apply the statistical and Linear Programming tools for engineering problems.

OBJECTIVES

- To make the students acquire a fundamental knowledge in Statistical inference and Linear programming tools for engineering applications.

UNIT I TESTING OF HYPOTHESIS 12

Sampling distributions - Tests for single mean , proportion and difference of means (large and small samples) – Tests for single variance and equality of variances – χ^2-test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 12

Completely randomized design – Randomized block design – Latin square design - 2^2 - factorial design.

UNIT III STATISTICAL QUALITY CONTROL 12

Control charts for measurements ($\bar{X}$ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling

UNIT IV LINEAR PROGRAMMING 12

Formulation – Graphical solution – Simplex method – Big-M method -Transportation and Assignment models

UNIT V ADVANCED LINEAR PROGRAMMING 12

Duality – Dual simplex method – Integer programming – Cutting-plane method – Branch and bound technique.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, 2007 (For units 1, 2 and 3).
2. H.A. Taha, "Operations Research", Pearson Education, Asia, 8th edition, 2007 (For units 4 and 5).

REFERENCES:

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K.Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th edition, 2007.
2. J.L. Devore, "Probability and Statistics for Engineering and the Sciences", Thomson Brooks/Cole, International Student Edition, 7th edition, 2008.
3. W.L. Winston, "Operations Research – Applications and Algorithms", Thomson, 1st Indian Reprint, 4th edition, 2007

MA9268 STATISTICS AND NUMERICAL METHODS L T P C
3 1 0 4

AIM

This course aims at providing the required skill to apply the statistical tools in engineering problems and gives a complete procedure for solving numerically the different kinds of problems occurring in engineering and technology .

OBJECTIVES

- The students will have a fundamental knowledge of the concepts of statistical inference
- The students would be acquainted with the basic concepts of numerical methods and their applications.

UNIT I TESTING OF HYPOTHESIS 12

Sampling distributions – Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 12

Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Newton-Raphson method – Gauss Elimination method – Pivoting – Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix Inversion by Gauss-Jordan method – Eigenvalues of a matrix by Power method .

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 12

Lagrange's and Newton's divided difference interpolation – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATION 12

Taylor's series method - Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Milne's predictor-corrector methods for solving first order equations – Finite difference methods for solving second order equation.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Johnson, R.A. and Gupta, C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, (2007).
2. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, (2004).

REFERENCES:

1. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8th edition, (2007).
2. Spiegel, M.R., Schiller, J. and Srinivasan, R.A., "Schaum's Outlines Probability and Statistics", Tata McGraw Hill edition, (2004).
3. Chapra, S. C. and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, (2007).
4. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, (2006).

EE9049 CONTROL SYSTEM DESIGN L T P C
3 0 0 3

AIM

To provide the concepts of linear and non linear system design.

OBJECTIVES

To impart knowledge on

- System design using root locus method.
- Design using frequency response method.

- State space design.
- Conventional techniques for non linear systems.
- Process identification and PID tuning for the same.

UNIT I CONTROL SYSTEM DESIGN BY THE ROOT LOCUS METHOD 9

Preliminary of Design considerations – Lead – Lag – Lag Lead Compensation

UNIT II CONTROL SYSTEM DESIGN BY FREQUENCY RESPONSE 9

Lead Compensation – Lag Compensation – Lag Lead compensation

UNIT III DESIGN IN STATE SPACE 9

Pole Placement – State observer – Design of regular system with observer – Design of Control Systems with observers.

UNIT IV NON-LINEAR SYSTEMS 9

Common Non linearity – Phase Plane Method: Basic Concepts – Singular Points – Stability of non Linear Systems – Construction of Phase trajectories – Deriving Describing Functions – Stability Analysis by Describing Function Method.

UNIT V CLASSICAL PID CONTROL & RELAY FEEDBACK 9

PID Control – Features and implementation – Direct and Model based Tuning – Shapes of Relay Response – Model structures and identification – Implications for Control.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Katsuhiko Ogata, Modern Control Engineering, 4th Edition, Prentice-Hall (Pearson Education, Inc.), New Delhi, 2006.
2. Jacqueline Wilkie, Michael Johnson, Reza Katebi, Control Engineering-An Introductory course, 1st Edition, Palgrave Publishers Ltd.(Formerly Macmillan Press Ltd.), New Delhi,2005
3. M. Gopal, Control Systems Principles and Design, 2nd Edition, Tata Mc-Graw Hill, N.Delhi, 2006.

REFERENCES:

1. Cheng-Ching Yu, Autotuning of PID Controllers: A Relay Feedback Approach, 2nd Edition, Springer, 2006.
2. Chi-Tsong Chen, Linear System Theory & Design, 3rd Edition, Oxford University Press, 1998.
3. Reymond T. Stefani, Bahram Shahian, Clement J. Savant Jr., Gene H. Hostetter, Design of Feedback Control Systems, Oxford University Press, 2007.

EE9048 ADVANCED CONTROL SYSTEM L T P C
3 0 0 3

AIM

To introduce the concepts of optimal and digital control systems with system identification techniques to undergraduate students.

OBJECTIVES

- To introduce the concepts of controllers and their design.
- To provide the concepts of state variable and output feedback for LTI systems.
- To provide the concepts of digital control systems.
- To provide the concepts of optimization in providing control solutions for LTI systems.
- To introduce the concepts of system identification and parameter estimation.

UNIT I CONVENTIONAL DESIGN OF CONTROLLERS 9

System performance and specifications – Proportional, Integral and Derivative controllers – Structure – Empirical tuning – Ziegler Nichols – Cohen coon – Root Locus method –Tuning using ISE, IAE and ITAE and other performance indices – Design of Lead-lag compensators –Design using Bode plots – polar plots- Nichols charts – Root locus and Routh Hurwitz criterion.

UNIT II DESIGN USING STATE SPACE METHODS 9

Control Law design – State feedback and pole placement- Estimator design – Regulator design -Combined control law and estimator – Introduction of the Reference input – Integral control and disturbance estimation – Effect of delays.

UNIT III OPTIMAL CONTROL 9

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

UNIT IV DIGITAL CONTROL 9

Digitization – Effect of sampling – PID control – Discrete system analysis and design using Z transform – Sampled –data analysis –Discrete equivalents – State space design methods – Sample rate selection.

UNIT V SYSTEM IDENTIFICATION 9

Defining the model set for linear system – Identification of Nonparametric models – Models and Criteria for parametric identification – Deterministic estimation – Stochastic Least Squares – Maximum Likelihood algorithm – Numerical search for Maximum Likelihood Estimate –Subspace Identification methods.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gene F. Franklin, J. David Powell, and Michael Workman, " Digital Control of Dynamic Systems", Prentice Hall of India (Pearson Education, Inc.), New Delhi 2002.
2. Benjamin C.Kuo, "Digital Control Systems", Oxford University Press, Second Edition, 2006.

REFERENCES:

1. Gene F. Franklin, J. David Powell and Abbasemami-Naeini, " Feedback Control of

Dynamic Systems", Fourth edition, Prentice Hall of India(Pearson Education,Inc.) 2002.
2. Anderson and moore, "Optimal control: Linear Quadratic methods", Prentice Hall of India (Pearson Education, Inc.),
3. K.J. Astrom, " Adaptive control", Pearson Education, Inc. 2nd ed, 1995.
4. Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, " Control System Design", Prentice Hall of India (Pearson Education, Inc.), New Delhi 2003,

EE9022 DIGITAL CONTROL AND INSTRUMENTATION L T P C
3 0 0 3

AIM

To learn Digital Control and measurements using electronic circuits and their applications.

OBJECTIVES

- To study the conventional, state space and digital control techniques.
- To get familiar with the design and realization of circuits with automation and control in measuring instruments with electronic circuits and digital display.
- To study various digital techniques used to measure voltage, current, energy, power and non-electrical parameters.
- To introduce peripheral interfaces for data logging and transmission.
- To discuss on interfacing for PC Based instrumentation.
- To introduce latest trends in digital instrumentation.

UNIT I CONVENTIONAL AND STATE SPACE DESIGN 9

System performance and specifications – Proportional, Integral and Derivative controllers – Structure – Empirical tuning – Design of Lead-lag compensators –Design using Bode plots –Design using Root locus - Control Law design – State feedback and pole placement- Estimator design –Regulator design : Combined control law and estimator .

UNIT II DIGITAL CONTROL 9

Digitization – Effect of sampling – PID control – Discrete system analysis and design using Z transform – Sampled –data analysis –Discrete equivalents – State space design methods – Sample rate selection.

UNIT III PERIPHERAL INTERFACES 9

Basic system components – Data Acquisition and conversion, Principle of ADCs and DACs clock generator, address decoder, 8 – bit bus interface circuits, RS232/RS485, GPIB, USB instrument bus interface standards, digital data modulation and transmission. PC Based data acquisition system. Modems and LAN interface.

UNIT IV COMPUTER AIDED DESIGN OF INSTRUMENTS 9

Tools for modeling, design, testing and calibrating digital instrument using LABVIEW, HPVEE, case study for digital voltmeter and digital PID controller for temperature control.

UNIT V DIGITAL INSTRUMENTS 9

Digital – counters, period measurement, voltmeter, multimeter, frequency meter, LCR meter, phase meter, tachometer, Q meter. Digital storage CRO, spectrum analyser, digital data recorder.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gene F. Franklin, J. David Powell, and Michael Workman, "Feedback Dynamic Systems", Prentice Hall of India (Pearson Education, Inc.), New Delhi 2002.
2. Benjamin C.Kuo, "Digital Control Systems", Oxford University Press, Second Edition, 2006.
3. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, second edition, 2006.
4. Albert D. Helfrick, William D. Cooper, 'Modern electronic Instrumentation and Measurement techniques', Pearson education, edition 2005.

REFERENCES:

1. M.M.S. Anand,'Electronic Instruments & Instrumentation Technology,' Prentice - Hall 2006.
2. A. J. Bouwens 'Digital Instrumentation', Tata McGraw-Hill edition 1997.
3. N. Mathivanan, 'Microprocessors, PC Hardware and Interfacing', Prentice-Hall 2003.
4 Robert H. Bishop, 'Learning with Labview^{TM} 7 Express', Pearson Education, edition 2005.
5. Graham C. Goodwin, Stefan F. Gradbea and Mario E. Salgado," Control System Design", PHI.

MG9401 PRINCIPLES OF MANAGEMENT L T P C
3 0 0 3

AIM

To learn the different principles and techniques of management in planning, organizing, directing and controlling.

OBJECTIVES

- To study the historic development of Management thoughts
- To learn the nature and purpose of planning, forecasting and decision making
- To learn the concepts of organizing, delegation of authority and HRD concepts

UNIT I HISTORICAL DEVELOPMENT OF MANAGEMENT THOUGHTS 9

Definition of Management – Management is science or Art – Comparison of Management and Administration – Development of Management thoughts – Contribution of F.W Taylor and H.Fayol's – Types of Business organization.

UNIT II PLANNING 9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning promises – Process of MBO – Forecasting in planning – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formation of organizations – Formal and informal organization – organization chart and manual – types of organization structure – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – advantages and disadvantages – staffing – selection and recruitment process – techniques – HRD – Managerial effectiveness.

UNIT IV DIRECTING 9

Scope – human factors in directing - integrating objectives – leadership – types and theories of leadership – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – communication – process of communication – barrier in communication – effective communication – impact of technology in organization communication.

UNIT V CONTROLLING 9

System and process of controlling – requirement for effective control – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting – global business environment – globalization and liberalization – intervention management and global theory of management.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 . Harold Kooritz & Heinz Weihrich “Essentials of management” Tata McGraw hill 1998.
2. Joseph L.Massie “Essentials of Management” Pearson Education, 4th Edition 2003.

REFERENCES:

1. Tripathy PC and Reddy PN, “Principles of Management”, Tata Mcgraw Hill, 1999
2. Decenzo David, Robbin Stephen A,”Personnnel and human Reasons Management” Prentice hall of ndia, 1996.
3. JAF Stomer, Freeman R.E and Daniel R Gilbert Management, Pearson Education, 6th Edition, 2004.
4. Fraidoon Mazda, “Engineering Management” Addision Wesley 2000.

GE 9022 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

AIM:

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

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve quality.
- To learn the various statistical approaches for Quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES 9

Leadership – Strategic quality planning, Quality statements - Customer focus Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Dale H.Besterfiled, et at., “Total Quality Management”, Pearson Education Asia, Third Edition, Indian Reprint (2006).

REFERENCES:

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
3. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd.,2006.
4. Janakiraman,B and Gopal, R.K, “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006.

GE9074 ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING L T P C 3 0 0 3

UNIT I MANAGERIAL ECONOMICS 9

Relationship with other disciplines – Firm: types & Objectives – Managerial decisions. Analysis methods.

UNIT II DEMAND & SUPPLY ANALYSIS 9

Demand –Types of demand – Determinants of demand – demand function – demand elasticity – demand forecasting – supply – Determination of supply – supply function – supply elasticity.

UNIT III PRODUCTION AND COST ANALYSIS 9

Production function – returns to scale – production optimisation – least cost input – Isoquants – Managerial uses of production function. Cost concepts – cost function – Determinants of cost – Short run and long run cost curves – Cost output decisions – Estimation of cost.

UNIT IV PRICING 9

Determinants of price – Pricing under different objectives – Pricing under different market structures – price discrimination – pricing methods in practice.

UNIT V FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT) 9

Balance sheet and related concepts – Profit & Loss statement and related concepts – Financial Ratio Analysis – Cash flow analysis – Fund flow Analysis – Analysis and interpretation of financial statements – Comparative financial statements.

CAPITAL BUDGETING (ELEMENTARY TREATMENT)

Investments – Risks and return evaluation of investment – Net present value – Internal rate of return.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS:

1. Paul, A.S and Nordhaus W.D., "Economics", Tata Mcgraw Hill Publishing Company Limited, New Delhi 2004.
2. Dominick, S., "Managerial Economics in a global economy", Thomson South Western, 4th edition, 2001.

REFERENCES:

1. Shah, P., "Basic Financial Accounting for Management" Oxford university Press, New Delhi, 2007.
2. Horne J.C.V. and Wachowicz Jr., J.M., "Fundamentals of financial Management", Prentice Hall of India, New Delhi, 11th Edition, 2004.
3. Mote, V.L, Paul, S. and Gupta, G.S., "Managerial Economics Concepts & Cases", Tata Mcgraw-Hill Publishing Company Limited, 38th Reprint, 2005.

GE9023 FUNDAMENTALS OF NANOSCIENCE L T P C
3 0 0 3

AIM:

To make the students understand the importance ,relevance and potentialities of this emerging field of study.

OBJECTIVES:

- Study the basic nano technology and nano science.
- Understand interdisciplinary nature of this field.
- Understand the important role of physics, chemistry ,biology.
- Recognize that the rules of nano science are fundamentally different than those we experience.
- Study the basic fabrication strategies of nano science.

UNIT I INTRODUCTION 10

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 5

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 10

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

REFERENCES:

1. G Timp (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.

EE9028 **COMPUTER ARCHITECTURE** **L T P C**
3 0 0 3

AIM

To understand the architecture of different processor and its associative units

OBJECTIVES

To provide a clear understanding of

- Computer arithmetic and logic unit design.
- Control Mechanism and CPU functioning.
- Pipeline architecture and vector processing.
- Input and output organizations and interfacing.
- Various memories and their organization.

UNIT I BASIC STRUCTURE OF COMPUTERS 9

Functional units – Basic operational concepts – Bus structures – Performance and Metrics – Instruction and instruction sequencing – hardware – software interface – addressing modes – instruction set – RISC – CISC – ALU design – fixed point and floating point operation.

UNIT II CONTROL AND CENTRAL PROCESSING UNIT 9

Micro programmed control – Control memory, address sequencing, micro program example, and design of control unit. Central processing unit – general register organization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, reduced instruction set computer.

UNIT III COMPUTER ARITHMETIC, PIPELINE AND VECTOR PROCESSING 9

Computer arithmetic – addition and subtraction, multiplication algorithms, division algorithms, floating point arithmetic operations decimal arithmetic unit, decimal arithmetic operations. Pipeline and vector processing – Parallel processing, pipelining, arithmetic pipeline, instruction pipeline, vector processing array processors.

UNIT IV INPUT OUTPUT ORGANIZATION 9

Input output organization : peripheral devices, input output interface, asynchronous data transfer , modes of transfer, priority interrupt, direct memory access, input output interface, serial communication.

UNIT V MEMORY ORGANIZATION 9

Memory organization – memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memory management hardware.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Morris Mano, ‘Computer system architecture’, 3rd edition, Pearson education 2002
2. Behrooz Parhami, ‘Computer Architecture’, Oxford University Press, 2005.

REFERENCES:

1. Vincent P. Heuring and Harry F. Jordan, ‘ Computer systems design and architecture’, Pearson Education Asia Publications, 2004.
2. John P. Hayes , ‘ Computer Architecture and Organization’, Tata McGraw-Hill, 1988.
3. Andrew S Tannenbaum ‘ Structured Computer Organization ‘, 5th edition Pearson Education 2007.

4. William Stallings ,' Computer Organization and architecture', 7th edition Pearson Education 2006.

EE9029 OPERATING SYSTEMS L T P C
3 0 0 3

AIM

To study the basic functions and design concepts of Operating Systems

OBJECTIVES

To provide in depth understanding of

- The basics with the classification and structures of Operating Systems
- The concept of process management and CPU Scheduling
- Storage management and File System Interface.
- Input / Output systems and Mass storage structure.

UNIT I INTRODUCTION 9

Introduction: Mainframe Systems - Desktop Systems - Multiprocessor Systems - Distributed Systems - Clustered Systems - Real-Time Systems - Handheld Systems. Computer System Structure: Computer System Operation - I/O Structure - Storage Structure - Storage Hierarchy - Hardware Protection - Network Structure. Operating System Structures: System Components - Operating System Services - System Calls - System Programs - System Structure - Virtual Machines - System Design and Implementation - System Generation.

UNIT II PROCESS MANAGEMENT 9

Processes: Concepts - Process Scheduling - Operations on Processes - Cooperating Processes - Interprocess Communication - Communication in Client-Server Systems. CPU Scheduling: Basic Concepts - Scheduling Criteria - Scheduling Algorithms - Multiprocessor Scheduling - Real-Time Scheduling - Process Scheduling Models. Critical Section Problem - Semaphores and Monitors. Deadlocks: Deadlock Characterization - Prevention, Avoidance and Detection of Deadlocks - 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. File System Interface: File Concept - Access Methods - Directory Structure - File-System Mounting - File Sharing - Protection. File System Implementation: Structure and Implementation - Directory Implementation - Allocation Methods - Free-Space Management.

UNIT IV I/O SYSTEMS 9

I/O Systems: Overview - I/O Hardware - Application I/O Interface - Kernel I/O Subsystem - Transforming I/O to Hardware Operations - STREAMS. Mass-Storage Structure: Disk Structure - Disk Scheduling - Disk Management - Swap-Space Management.

UNIT V PROTECTION, SECURITY AND CASE STUDIES 9

Protection: Goals - Domain of Protection - Access Matrix - Revocation of Access Rights. Security: The Security Problem - User Authentication - Program Threats - System Threats - Securing Systems and Facilities - Intrusion Detection - Cryptography. Case Studies: Linux - Design Principles - Kernel Modules - Scheduling - File Systems. Windows XP - Design Principles - Brief Overview of System Components - File Systems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 'Operating System Concepts', 6th Edition, Windows XP Update, John Wiley & Sons Inc., 2005.
2. William Stallings, 'Operating Systems', 5th Edition, PHI / 5th Edition Pearson Education.

REFERENCES:

1. Harvey M Deitel, 'Operating Systems', 2nd Edition, Pearson Education, 2002
2. Andrew S Tanenbaum, 'Modern Operating Systems', 2nd Edition, Pearson Education 2000 / PHI.
3. Milan Milenkovic, "Operating Systems Concepts and Design", 2nd Edition, Tata McGraw Hill,2007.

EE9030 SOFT COMPUTING L T P C
3 0 0 3

AIM

To cater the knowledge of Neural Networks, Fuzzy Logic Control, Genetic Algorithm and Evolutionary Programming and their applications for controlling real time systems.

OBJECTIVES

- To expose the students to the concepts of feed forward neural networks.
- To provide adequate knowledge about feed back neural networks.
- To teach about the concept of fuzziness involved in various systems. To provide adequate knowledge about fuzzy set theory.
- To provide comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.
- To provide adequate knowledge of application of fuzzy logic control to real time systems.
- To expose the ideas of GA and EP in optimization and control.

UNIT I ARCHITECTURES - ANN 9

Introduction – Biological neuron – Artificial neuron – Neuron modeling – Learning rules – Single layer – Multi layer feed forward network – Back propagation – Learning factors.

UNIT II NEURAL NETWORKS FOR CONTROL 9

Feed back networks – Discrete time hop field networks – Transient response of continuous time networks – Applications of artificial neural network - Process identification – Neuro controller for inverted pendulum.

UNIT III FUZZY SYSTEMS AND FUZZY LOGIC CONTROL 9

Classical sets – Fuzzy sets – Fuzzy relations – Fuzzification – Defuzzification – Fuzzy rules - Membership function – Knowledge base – Decision-making logic – Optimisation of membership function using neural networks – Adaptive fuzzy system.

UNIT IV OPTIMIZATION TECHNIQUES 9

Gradient Search – Non-gradient search – Genetic Algorithms: Operators, search algorithm, penalty – Evolutionary Programming: Operators, Search Algorithms – Applications to Electrical problems.

UNIT V APPLICATION OF FLC 9

Fuzzy logic control – Inverted pendulum – Image processing – Home heating system – Blood pressure during anesthesia – Introduction to neuro fuzzy controller.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Laurance Fausett, Englewood cliffs, N.J., 'Fundamentals of Neural Networks', Pearson Education, 1992.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Tata McGraw Hill, 1997.
3. David Goldberg, "Genetic Algorithms and Machine learning", PHI

REFERENCES:

1. Jacek M. Zurada, 'Introduction to Artificial Neural Systems', Jaico Publishing home, 2002.
2. H.J. Zimmermann, 'Fuzzy Set Theory & its Applications', Allied Publication Ltd., 1996.
3. Simon Haykin, 'Neural Networks', Pearson Education, 2003.
4. John Yen & Reza Langari, 'Fuzzy Logic – Intelligence Control & Information', Pearson Education, New Delhi, 2003.

EE9031 OPERATIONS RESEARCH L T P C
3 0 0 3

AIM

To learn the resource management concepts by Operation Research

OBJECTIVES

- To learn the various OR models
- To study the dual problem concepts
- To acquire the knowledge of transportation model, network applications and diagram presentations

UNIT I OPERATION RESEARCH MODELS 9

Operations Research Techniques – Art of Modeling – Construction of LP Model – Graphical LP solution – Graphical Sensitivity Analysis - The Simplex Algorithm – The M.Method – The two phase method – degeneracy – Alternative optima – unbounded solutions – infeasible solution – redundancies – LP packages.

UNIT II DEFINITION OF THE DUAL PROBLEM 9

Primal-dual relationship – Economic interpretation of duality – Dual simplex method – primal dual computation – post optimal or sensitivity analysis – Changes affecting feasibility – Changes affecting optimally – Revised simplex method – LP packages.

UNIT III DEFINITION OF TRANSPORTATION MODEL 9

The transportation algorithm – Determination of the starting solution – Iterative computations of the Algorithm – The Assignment Model – The Hungarian method – The Transhipment model – Inter programming problem – Cutting plane Algorithm.

UNIT IV SCOPE OF NETWORK APPLICATIONS 9

Network solution – Minimal spanning tree Algorithm – Shortest Route problem – Examples – Shortest Route Algorithm – Maximal flow model – Minimum cost capacitated flow problems.

UNIT V NETWORK DIAGRAM REPRESENTATION 9

Critical path method – Time estimates – Crashing – Time charts – PERT and CPM for project scheduling – Resource planning – Case studies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Handy A. Taha, “Operation Research – An Introduction”, 7th Edition, Pearson Education, Asia 2002.
2. Hiller F.S.Liberman G.J, “Introduction to Operation Research”, 6th Edition, McGraw Hill, 1995.

REFERENCES:

1. Ronald. L.Rardin, “Optimization in Operation Research”, Pearson Education, Asis, 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”, 6th Edition, McGraw Hill, 1995.
4. R.Panneer Selvam, “Operations Research”, Prentice Hall of India, 2002.
5. P.C.Tulsin, “Quantitive Technique: Theory and Problem:. Pearson Education, 2002.
6. Ravichandran, Philips, Solberg, “Operation Researchy Principles and Practice”, Second Edition, john wiley, 1987.

EE9032 **PROGRAMMING IN JAVA** **L T P C**
3 0 0 3

AIM

To study the programming language JAVA in detail

OBJECTIVES

At the end of this course students will be able to

- Appreciate the flavour of Java programming language
- Have a thorough understanding of OOP concept using Java
- Write programmes using AWT
- Have a detailed knowledge about Applets in Java

UNIT I INTRODUCTION **9**

Java as programming tool - Advantages of Java - Java Buzzwords - Java Programming Environment - Compiling and running Java Programs - Fundamental Programming structure in Java - Data Types, Operators, Strings, Control Flow, Class Methods, Arrays.

UNIT II OBJECTS AND CLASSES **9**

Introduction to OOP - Building Own Classes - Packages - Inheritance - First Steps with Inheritance - Casting - Abstract Classes - Protecting Access - RTTI - Reflection - Design hints for Inheritance - Interface - Inner Classes.

UNIT III GRAPHICS PROGRAMMING **9**

Introduction - Creating a Closeable Frame - Terminating Graphics Program - Frame Layout - Displaying Information in a Frame - Graphics Object - Text and Fonts - Colors - Drawing Shapes - Filling Shapes - Event Handling - Basics of Event Handling - The AWT event hierarchy - Individual Events - Advanced Event Handling.

UNIT IV SWINGS AND APPLETS **9**

The Model - View - Controller Design Pattern - Introduction to Layout Management - Text Input - Making Choices - Scroll Bars - Sophisticated Layout Management - Menus - Dialog Boxes - Applets - Applet Basics - Simple Applet - Testing Applets - Security Basics - Converting Application to Applets - Applet HTML Tags and Attributes.

UNIT V EXCEPTION HANDLING AND FILES **9**

Exception and Debugging – Dealing with Errors – Catching Exception – Debugging Techniques – Streams and Files – Streams, Types and Putting Streams to use – Object Streams – File Management.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Deitel & Deitel, “Java: How to Program”, 7th Edition, Prentice Hall of India.
2. Patrik Narton, “The Complete Reference JAVA2”, Tata McGraw Hill, 2000.

REFERENCES:

1. Schildt, “Java: A Beginner’s Guide”, 3rd Edition, (Osborne Reprint), Tata McGraw Hill, 2005.
2. Schildt, “Java: The Complete Reference”, 7th Edition, Tata McGraw Hill, 2006.
3. Hartamann and Cornell, “Core Java Fundamentals Vol. 1”, PTR (Sun Series), Addison Wesley, 2000.

EE9033 ADVANCED TOPICS IN POWER ELECTRONICS L T P C
3 0 0 3

AIM

To study low power SMPS and UPS technologies

OBJECTIVE

To provide conceptual knowledge in modern power electronic converters and its applications in electric power utility.

UNIT I DC-DC CONVERTERS 9

Principles of stepdown and stepup converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters.

UNIT II SWITCHING MODE POWER CONVERTERS 9

Analysis and state space modeling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques.

UNIT III RESONANT CONVERTERS 9

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS , Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control .

UNIT IV DC-AC CONVERTERS 9

Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

UNIT V POWER CONDITIONERS, UPS & FILTERS 9

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters, Applications and design- Third Edition- John Wiley and Sons- 2006
2. M.H. Rashid – Power Electronics circuits, devices and applications- third edition Prentice Hall of India New Delhi, 2007.

REFERENCES:

1. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.
2. Kjeld Thorborg, “Power Electronics – In theory and Practice”, Overseas Press, First Indian Edition 2005.
3. Philip T Krein, “ Elements of Power Electronics”, Oxford University Press

EE9034 **POWER QUALITY** **L T P C**
3 0 0 3

AIM

To introduce the concepts related to power quality and the mitigation techniques

OBJECTIVES

- To introduce power quality terms and definitions
- To introduce the concepts of conventional and modern mitigation techniques
- To expose the students to various types of power monitoring equipment

UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and Definitions: Overloading, undervoltage, sustained interruption, sags and swells, waveform distortions, Total harmonic distortion (THD), Computer Business Equipment Manufacturers Associations (CBEMA) curve, Harmonic Distortion: Voltage and current distortion, harmonic indices, harmonic sources from commercial and industrial loads.

UNIT II VOLTAGE SAGS AND INTERRUPTIONS 9

Sources of sags and interruptions, estimating voltage sag performance, motor starting sags, estimating the sag severity, mitigation of voltage sags, active series compensators, static transfer switches and fast transfer switches .

UNIT III OVERVOLTAGES 9

Sources of overvoltages: Capacitor switching, lighting, ferroresonance; Mitigation of voltage swells: surge arrestors, low pass filters, power conditioners – Lightning Protection, shielding, line arrestors, protection of transformers and cables, computer analysis tools for transients, PSCAD and EMTP

UNIT IV HARMONICS 9

Locating harmonic sources: power system response characteristics, resonance, harmonic distortion evaluation, devices for controlling harmonic distortion, passive filters, active filters, IEEE and IEC standards.

UNIT V POWER QUALITY MONITORING 9

Monitoring considerations: Power line disturbance analyzer, power quality measurement equipment, harmonic / spectrum analyzer, flicker meters, disturbance analyzer, applications of expert system 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
2. G.T.Heydt, "Electric Power Quality", Stars in a circle publishers, 1994, 2nd Edition.

REFERENCE:

1. Aravindam Ghosh, "Power Quality enhancement using custom power devices" Kluwer Academic Publishers, 2002.

EE9035 POWER SYSTEM TRANSIENTS L T P C
3 0 0 3

AIM

To understand the generation of switching and lightning transients, their propagation, reflection and refraction on the grid and their impact on the grid equipment.

OBJECTIVES

- To study the generation of switching transients and their control using circuit – theoretical concept.
- To study the mechanism of lightning strokes and the production of lightning surges.
- To study the propagation, reflection and refraction of travelling waves.
- To study the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

UNIT I INTRODUCTION AND SURVEY 6

Source of transients, various types of power systems transients, effect of transients on power systems, importance of study of transients in planning.

UNIT II SWITCHING TRANSIENTS 12

Introduction, circuit closing transients: RL circuit with sine wave drive, double frequency transients, observations in RLC circuit and basic transforms of the RLC circuit. Resistance switching: Equivalent circuit for the resistance switching problems, equivalent circuit for interrupting the resistor current. Load switching: Equivalent circuit, waveforms for transient voltage across the load, 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, ferroresonance.

UNIT III LIGHTNING TRANSIENTS 9

Causes of overvoltage, lightning phenomenon, charge formation in the clouds, rate of charging of thunder clouds, mechanisms of lightning strokes, characteristics of lightning strokes; factors contributing to good line design, protection afforded by ground wires, tower footing resistance. Interaction between lightning and power system: Mathematical model for lightning.

UNIT IV TRAVELLING WAVES ON TRANSMISSION LINE – COMPUTATION OF TRANSIENTS 9

Computation of transients: Transient response of systems with series and shunt lumped parameters and distributed lines. Travelling 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 voltage 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; 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. R.D.Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.

REFERENCES:

1. C.L.Wadhwa, 'Electrical Power Systems', New Age International Pvt., Ltd., 2007
2. Pritindra Chowdhari, " Electromagnetic transients in Power Systems", Wiley and Sons Inc., New York, 1991

EE9036 SPECIAL ELECTRICAL MACHINES L T P C
3 0 0 3

AIM

To explore the theory and applications of special machines.

OBJECTIVES

- To review the fundamental concepts of permanent magnets and the operation of permanent magnet brushless DC motors.
- To introduce the concepts of permanent magnet brushless synchronous motors and synchronous reluctance motors.
- To develop the control methods and operating principles of switched reluctance motors.
- To introduce the concepts of stepper motors and its applications.
- To understand the basic concepts of other special machines.

UNIT I PERMANENT MAGNET BRUSHLESS DC MOTORS 9

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis-EMF and Torque equations- Characteristics and control

UNIT II PERMANENT MAGNET SYNCHROUNOUS MOTORS 9

Principle of operation – EMF and Torque equations - Phasor diagram - Power controllers – Torque speed characteristics – Digital controllers – Constructional features, operating principle and characteristics of synchronous reluctance motor.

UNIT III SWITCHED RELUCTANCE MOTORS 9

Constructional features –Principle of operation- Torque prediction –Characteristics- Power controllers – Control of SRM drive- Sensorless operation of SRM – Applications.

UNIT IV STEPPER MOTORS 9

Constructional features –Principle of operation –Types – Torque predictions – Linear and Non-linear analysis – Characteristics – Drive circuits – Closed loop control – Applications.

UNIT V OTHER SPECIAL MACHINES 9

Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear motor – Permanent magnet DC and AC motors, Applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. T.J.E. Miller, 'Brushless magnet and Reluctance motor drives', Claredon press,

London, 1989.
2. R.Krishnan, ' Switched Reluctance motor drives' , CRC press, 2001.
3. T.Kenjo, ' Stepping motors and their microprocessor controls', Oxford University press, New Delhi, 2000.

REFERENCES:

1. T.Kenjo and S.Nagamori, 'Permanent magnet and Brushless DC motors', Clarendon press, London, 1988.
2. R.Krishnan, ' Electric motor drives' , Prentice hall of India,2002.
3. D.P.Kothari and I.J.Nagrath, ' Electric machines', Tata Mc Graw hill publishing company, New Delhi, Third Edition, 2004.
4. Irving L.Kosow, "Electric Machinery and Transformers" Pearson Education, Second Edition, 2007.

EE9037 EHV POWER TRANSMISSION L T P C
3 0 0 3

AIM

To study the various types of EHV transmission systems.

OBJECTIVES

To impart knowledge on

- EHV AC transmission trends and parameters calculation
- HVDC and FACTS
- Effect of EHV lines on living origanisms

UNIT I TRANSMISSION LINE TRENDS 9

Standard transmission voltages, average values of line parameters – Power handling capacity and line losses – number of lines.

UNIT II LINE AND GROUND PARAMETERS 9

Calculation of line and ground parameters – R, C, L, Bundle conductors, Modes of propagation – Effect of earth.

UNIT III HIGH VOLTAGE DIRECT CURRENT (HVDC) 9

HVDC system-Principle of operation, control and design consideration, HVDC circuit breaking

UNIT IV FACTS 9

Basic concepts- Reactive power control, uncompensated transmission line, series compensation, SVC, thyristor control, series capacitor, static synchronous compensator, unified power flow controller and applications.

UNIT V ELECTROSTATIC AND MAGNETIC FIELDS OF EHV LINES 9

Electric shock – threshold currents – Calculation of electrostatic fields and magnetic fields of AC and DC lines – Effect of fields on living organism – Electrical field measurement.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rakosh Das Begamudre “Extra high voltage AC transmission Engineering”, New Age International Publishers, Third Edition, 2006.
2. Narain G Hingorani “Understanding FACTS” Standard Publishers Distributors,2001
3. P.Kundur “Power System stability and control”, Tata Mcgraw Hill Publishers, 1994

REFERENCES:

1. C.L.Wadhwa “Electrical Power Systems”, New Age International Publishers, Fourth Edition, 2005.
2. K.R.Padiyar, “HVDC Power Transmission System”, New Age International Publishers, First Edition, Reprint 2005
3. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarti, “A Text Book on Power System Engineering”, Dhanpat Rai & Co., 1998.
4. Mafen Abdel – Salam, Hussein Anis, Ahdab E-Moshedy, Roshdy Padwan “High Voltage Engineering – Theory & Practice”, Marcel Dekker Inc., 2000

EE9038 FLEXIBLE AC TRANSMISSION SYSTEMS L T P C
3 0 0 3

AIM

To become familiar with modeling, operation of various FACTS controllers and their impact on AC transmission system.

OBJECTIVES

- To understand the need for reactive power compensation in AC transmission system.
- To become familiar with modeling and operation of thyristor and voltage source inverter based FACTS controllers.
- To study the effect of FACTS controllers on AC transmission system.

UNIT I INTRODUCTION 9

Reactive power control in electrical power transmission lines - Uncompensated transmission line - series compensation – Basic concepts of static VAR Compensator (SVC) – Thyristor Switched Series capacitor (TCSC) – Unified power flow controller (UPFC).

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 12

Voltage control by SVC – Advantages of slope in dynamic characteristics – influence of SVC on system voltage – Design of SVC voltage regulator – 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) – Principle of operation – 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 6

Controller interactions – SVC – SVC interaction – Co-ordination of multiple controllers using linear control techniques – Control coordination using genetic algorithms.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Mohan Mathur.R., Rajiv . K.Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Inc 2000.
2. Narain G. Hingorani, "Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors, Delhi, 2001

REFERENCE:

1. A.T.John, "Flexible A.C. Transmission Systems", Institution of Electrical and Electronic Engineers (IEEE), 1999.

EE9039 ADVANCED POWER SYSTEM ANALYSIS L T P C
3 1 0 4

AIM

To learn the recent trends in power system engineering.

OBJECTIVES

- To model steady-state operation of large-scale power systems and to solve the power flow problems using efficient numerical methods suitable for computer simulation.
- To become familiar with modeling and operation of HVDC link and the principle of operation of FACTS.
- To become familiar with modeling aspects of synchronous machines and network for transient stability analysis of multi-machine power systems.
- To analyze voltage stability and sub-synchronous resonance phenomena of power system.

UNIT I POWER FLOW ANALYSIS 12

Review of LU factorization and NR method, Development of Fast Decoupled Power Flow (FDPF) model from N-R, Flowchart; numerical examples Multi-area power flow analysis - Contingency analysis – Simulation of single line and generator outages.

UNIT II ROTOR ANGLE STABILITY ANALYSIS 12

Small-signal stability of SMIB system: linearization of swing equation; concept of synchronizing power coefficient; determination of natural frequency of local mode of oscillation using linearised equation. Transient stability analysis of multi-machine power system: Synchronous machine representation by classical model and loads by constant admittances; algorithm for alternating solution approach through network solution using bus admittance matrix and state-equations using implicit integration method; usage of numerical algorithm for determination of critical clearing time by trial and error – methods of improving stability - digital simulation.

UNIT III VOLTAGE STABILITY ANALYSIS 12

Introduction – Transmission system aspects: Single-load infinite-bus system, maximum deliverable power, Power-voltage relationship, instability mechanisms- effect of compensation – V-Q curves – problems. Generator aspects: Frequency and voltage controllers – limiting devices affecting voltage stability – voltage reactive power characteristics of synchronous generators – capability curves. Load aspects: Voltage dependence of loads – load restoration dynamics – Induction motors – Load Tap Changers – Thermostatic load recovery

UNIT IV SUBSYNCHRONOUS OSCILLATIONS 12

Turbine - generator - torsional characteristics - torsional interaction with power system controls – sub synchronous resonance - impact of network-switching disturbances - torsional counter measures to SSR problems.

UNIT V HVDC AND FACTS 12

Review of six-pulse and twelve-pulse converter operation; equations for converter and inverter with simple HVDC link-Modes of operation- AC-DC load flow with a simple DC link, real and reactive power control in electrical power transmission line- SVC- TCSC-STATCOM- SSSC- UPSC -Basic operation –Applications.

L: 45 T: 15 TOTAL: 60 PERIODS

TEXT BOOKS:

1. T.V. Custem, C.Vournas, " Voltage Stability of Electric Power Systems ", Kluwer Academic Publishers, Boston/London/Dordrecht, 1998.
2. P. Kundur, ‘Power System Stability and Control, Tata McGraw Hill, Publications, 1994.
3. Narain G. Hingorani, “Understanding FACTS”, Standard Publishers Distributors, Delhi, 2001.

REFERENCES:

1. John J. Grainger and W.D. Stevenson Jr., ‘Power System Analysis’, Tata McGraw Hill Publishing Company Ltd., New Delhi,2003.
2. K.R. Padiyar, ‘Power System Dynamics’ BS Publications, India, 2002.
3. Hadi Saadat, ‘Power System Analysis’, Tata McGraw Hill Publishing Company, New Delhi, 2002.
4 Narain G. Hingorani, “Understanding FACTS”, Standard Publishers Distributors, Delhi-6.

EE9040 MICRO ELECTRO MECHANICAL SYSTEMS L T P C
3 0 0 3

AIM

To study the fundamentals of fabrication, design and applications of Micro Electro Mechanical Systems (MEMS)

OBJECTIVES

- To introduce the historical background of development of MEMS technology and micromachining.
- To study the process of surface micromachining.
- To study the principles of micro-sensors and their applications
- To study the principles of micro-actuators and their applications.
- To study some of the applications of MEMS technology.

UNIT I MICRO FABRICATION AND BULK MICROMACHINING 9

Historical background of Micro Electro Mechanical Systems (MEMS) and micro-machining – bulk micromachining – isotropic etching and anistropic etching, wafer bonding – high aspect ratio processes (LIGA).

UNIT II SURFACE MICROMACHINING 9

One or two sacrificial layer processes, Surface micromachining requirements – Pollysilicon surface micromachining – other compatible materials – SiliconNitride, Piezo electric materials surface micro machined systems – Success stories – Micro motors – Gear Trains, Mechanisms.

UNIT III PHYSICAL MICRO SENSORS 9

Classification of Physical sensors – Integrated, Intelligent or smart sensors – Sensor principles and examples: Thermal sensors, Electrical sensors, Mechanical sensors, Chemical and Biosensors.

UNIT IV MICROACTUATORS 9

Electromagnetic and thermal micro actuation – mechanical design of Microactuators – Microactuator examples – Microvalves, Micropumps, Micromotors, - Micro actuator systems – Ink Jet printer heads – Micro – Mirror TV Projector.

UNIT V APPLICATION AREAS 9

All mechanical miniature devices -3D electromagnetic actuators and sensors – RF electronic devices – Optical / Photonic devices – Medical devices : DNA – chip, micro arrays.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Stephen D.Senturia, "Micro System Design", Kluwer Academic Publishers, 2001.
2. Tsu, "Micro Electro Mechanical Systems", 2006

REFERENCES:

1. Marc Madou, "Fundamentals of Microfabrication", CRC Press, 1997.
2. Boston, "Micromachined Transducers Sourcebook", WCB McGraw Hill, 1998.
3. M.H.Bao, "Micromechanical transducers: Pressure Sensors, Accelerometers, and gyroscopes", by Elsevier, Newyork, 2000.

EE9041 **VLSI DESIGN** **L T P C**
3 0 0 3

AIM

To understand 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 analyze the CMOS circuits by layout Design.
- To understand the functioning of programmable and Reprogrammable devices.
- To learn about the programming of Programmable devices using Hardware description Language.

UNIT I BASIC MOS TRANSISTOR 9

Enhancement mode & Depletion mode – Fabrication (NMOS, PMOS, CMOS, BiCMOS) Technology – NMOS transistor current equation – 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 ELEMEMTS AND REGULAR ARRAY LOGIC 9

NMOS PLA – Programmable logic devices – Finite state Machine PLA – Introduction to FPGA,CPLD.

UNIT V VHDL PROGRAMMING 9

RTL Design, Structured level Design – combinational logic – types – Operators – packages – sequential circuit – subprograms – test benches.(Examples: address, counters, flip flops, fsm, multiplexers, demultiplexers).

TOTAL: 45 PERIODS

TEXT BOOKS:

1. D.A. Pucknell, K.Eshraghian , 'Basic VLSI design ',3rd edition, Prentice hall of India,New Delhi – 2003
2. Eugene D.Fabricius, 'Introduction to VLSI design', Tata McGraw Hill, 1990.

REFERENCES:

1. N.H.Weste, 'Principles of CMOS VLSI Design', Pearson Education, India, 2002.
2. Charles H.Roth,' Fundamentals of Logic design', Jaico Publishing House,1992
3. Zainalatstedin Navabi,' VHDL Analysis and Modelling of Digital systems', 2nd Edition, Tata McGraw Hill ,1998.
4. Douglas Perry, 'VHDL Programming by example', Tata McGraw Hill 3rd Edition.
5. J.Basker, 'A VHDL Synthesis', BS publication.
6. Parag K. Lala, 'Digital system design using PLD', BS Publications, 2003

EE9042 **MOBILE COMMUNICATION** **L T P C**
3 0 0 3

AIM

To introduce the mobile communication concepts using wireless medium for UG students.

OBJECTIVES

- To introduce the basic concepts of mobile communication systems used under interference parameters
- To understand the concepts of medium to aid propagation in wireless medium.
- To introduce various modulation and mitigation techniques
- To introduce the concepts of noiseless transmission and enhancement of number
- of users.
- To introduce different systems and standards.

UNIT I BASICS OF CELLULAR MOBILE 9

Evolution of mobile communication – mobile radio systems – cellular concept – mobility and frequency management of radio in vehicle traffic environment – frequency reuse – channel assignment – co-channel interference – hand off – interference & system capacity – trunking & GOS.

UNIT II PROPAGATION FACTORS IN MOBILE RADIO 9

Large scale path loss – path loss models – link budget design – small scale fading – fading due to multipath – delay spread and coherent bandwidth – flat fading – frequency selective – fading due to Doppler spread – fast fading – slow fading – parameters of mobile multipath channels – time dispersion parameters.

UNIT III MODULATION TECHNIQUES & MITIGATION 9

MSK, GMSK – QPSK – M Ary QAM, performane of MSK modulation : Techniques – linear and nonlinear equalisation, algorithms of adaptive equalisation ; diversity – time, frequency, polarization – diversity combiners – interleaving – RAKE receiver, OFDM.

UNIT IV CODING & MULTIPLE ACCESS METHODS 9

Vocoder, LPC, CELP, HELP, RELP – selection of codecs for mobile communication: GSM coders MA techniques: FDMA, TDMA, SDMA, CDMA power control - channel codes – (qualitative) comparison.

UNIT V SYSTEMS AND STANDARDS 9

1G Analog systems, AMPS – 2G digital systems: GSM, NADC, JDC, IS-95, IS-136, Standards DECT, CDMA one, Bluetooth, GPRS, UMTS; FDD & TDD – 3G: WCDMA.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. William Y.Lee “Cell mobile communication, analog and digital” McGraw Hill
2. Rappapot T.S “Wireless Communication” Pearson Education, 2003.

REFERENCES:

1. Principles of mobile communication by Gordon L.Stibur, Springer, 2001.
2. GSM, CDMA one & 3G systems by Raymond Steel and Lee, 2001, John Wiley.
3. Modern Wireless communication by Haykine & Maher, Pearson Education
4. R.Black, wireless Communication Tech. Thomson, 2003.
5. An Introduction to Wireless Technology, Pearson, 2003.

EE9043 CAD FOR ELECTRICAL APPARATUS L T P C
2 0 2 3

AIM

To learn about Computer aided design of electrical apparatus using FEM

OBJECTIVES:

To impart knowledge on :

- problem formulation for field computation
- Finite Element analysis
- computer aided design of practical problems

UNIT I INTRODUCTION 9

Review on electromagnetic theory- Basic field equations, calculation of field distribution, inductance, capacitance, force and torque, Review on conventional electrical machine design methodology – computer aided design aspects-advantages.

UNIT II CAD PACKAGES 9

Numerical methods for solving field problems, recent developments, problem formulation- governing equations – modeling - boundary conditions and material characteristics.

UNIT III FINITE ELEMENT ANALYSIS 12

Mathematical formulation for 2-D planar and axial symmetry problems – discretization-shape functions-element and global matrices/vectors –solution - post processing

UNIT IV FIELD ANALYSIS USING FEA(PRACTICALS) 15

Electrostatics, Magnetostatics - linear and non-linear problems, permanent magnet, eddy current analysis, calculation of force/ torque.

UNIT V DESIGN EXAMPLES (PRACTICALS) 15

Design of cylindrical magnetic devices, transformer,Rotating machines.

L: 30 T; 30 TOTAL: 60 PERIODS

TEXT BOOKS:

1. Sheppard.J.Salon “Finite Element Analysis of Electrical Machines”, Springer International Edition, First Indian Reprint ,2007
2. Nicola Bianchi “Electrical Machine Analysis using Finite Elements”, Taylor & Francis, 2005

REFERENCES:

1. K.J.Binns, P.J. Lawrenson, C.W.Trowbridge, “The analytical and numerical solution of electrical and magnetic fields”, John Wiley& Sons
2. Nathan Ida, Joao P A Bastos, “Electromagnetics and calculation of fields”, Springer Verlag, 1992
3. P P. Silvester , Ferrari, “Finite Elements for Electrical Engineers”, Cambridge University Press, 1984.
4. M V K Chari, P P Silvester, “Finite Elements in Electrical and Magnetic Field problems”, John Wiley, 1980.
5. S.S.Rao, “The Finite Element Method in Engineering”, Pergamon Press. 1989
6. J.N.Reddy, “An introduction to the Finite Element Method”, McGrawHill International Editions, 1993.

EE9044 DYNAMIC MODELING AND ANALYSIS OF ELECTRICAL MACHINES **L T P C 3 0 0 3**

AIM

To study the dynamic modeling and analysis of electrical machines.

OBJECTIVES

- To review the fundamentals of electro-mechanical energy conversion.
- To develop dynamic modeling and to perform analysis of Electrical Machines.
- To study the reference frame theory

UNIT I PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION 9

Magnetic circuits – stored magnetic energy, co-energy – force and torque – singly and doubly excited system – MMF pattern for DC and AC machines – calculation of air gap mmf and per phase machine inductance using physical machine data.

UNIT II DC MACHINES 9

Voltage and torque equations – dynamic characteristics of permanent magnet and shunt DC motors – state equations – solution of dynamic characteristics by Laplace transformation.

UNIT III REFERENCE FRAME THEORY 9

Static and rotating reference frames – transformation of variables – reference frames – transformation between reference frames – transformation of a balanced set – balanced steady state phasor and voltage equations – variables observed from several frames of reference.

UNIT IV INDUCTION MACHINES 9

Voltage and torque equations in machine variables – transformation in arbitrary reference frame – voltage and torque equation in reference frame variables – analysis of steady state operation – free acceleration characteristics – dynamic performance for load variations – computer simulation.

UNIT V SYNCHRONOUS MACHINES 9

Voltage and torque equation in machine variables – transformation in rotor reference frame (Park's equation) – voltage and torque equation in reference frame variables – analysis of steady state – dynamic performance for load variations – computer simulation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Paul C.Krause, Oleg Wasyzczuk, Scott D.Sudhoff, "Analysis of electrical machinery and drive systems", IEEE Press, Second Edition, 2005.
2. R.Krishnan, "Electrical Motor Drives, Modelling, Analysis and Control", Prentice Hall of India, 2002.

REFERENCES:

1. A.E.Fitzgearald, Charles Kingsley, Jr. and Stephen D.Umans, "Electric Machinery" Tata McGraw Hill, 5th Edition 1992.
2. Subramanyam V., "Thyristor Control of Electric Drives", Tata McGraw Hill Publishing Company Limited, New Delhi 1998.

EE9045 HIGH VOLTAGE DIRECT CURRENT TRANSMISSION L T P C
3 0 0 3

AIM

To learn the HVDC modelling and control strategy.

OBJECTIVES

- To study the performance of converters and modeling of DC line with controllers.
- To study about converter harmonics and its mitigation using active and passive filters.

UNIT I DC POWER TRANSMISSION TECHNOLOGY 9

Introduction-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 CONVERTER AND HVDC SYSTEM CONTROL 9

General principles of DC link control-converter control characteristics-system control hierarchy-firing angle control-current and extinction angle control-starting and stopping of DC link-power control-higher level controllers-telecommunication requirements.

UNIT IV HARMONICS AND FILTERS 9

Introduction-generation of harmonics-design of AC filters-DC filters-carrier frequency and RI noise.

UNIT V SIMULATION OF HVDC SYSTEMS 9

Introduction-system simulation: Philosophy and tools-HVDC system simulation-modeling of HVDC systems for digital dynamic simulation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Padiyar, K.R., HVDC power transmission system, Wiley Eastern Limited, New Delhi 1990.First edition.
2. P.Kundur, 'Power System Stability and Control', Tata McGraw Hill Publishing Company Ltd., USA, 1994.
3. Arrillaga, J., High Voltage direct current transmission, Peter Pregrinus, London, 1983.

REFERENCES:

1. Edward Wilson Kimbark, Direct Current Transmission, Vol. I, Wiley interscience, New York, London, Sydney, 1971.
2. Rakosh Das Begamudre, Extra high voltage AC transmission engineering New Age International (P) Ltd., New Delhi, 1990.

EE9046 AI APPLICATIONS TO POWER SYSTEMS L T P C
3 0 0 3

AIM

To learn the various Artificial Intelligence Techniques and their application to Power Systems.

OBJECTIVES

- To study about Artificial Neural Networks, Genetic Algorithm and Fuzzy Logic System.
- To apply AI techniques to Power Systems.

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 detailed 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 modelling and control schemes for nonlinear systems – Self-organizing fuzzy logic control – Fuzzy logic control for nonlinear time-delay system.

UNIT V APPLICATIONS TO POWER SYSTEMS 9

GA application to power system optimisation problems, Neural Network Application to Load Forecasting, Contingency Analysis, Application of Fuzzy Logic Controllers to Power System Stability..

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jacek.M.Zurada, "Introduction to Artificial Neural Systems", Jaico Publishing House, 1999.
2. Kosko,B. "Neural Networks And Fuzzy Systems", Prentice-Hall of India Pvt. Ltd., 1994.

REFERENCES:

1. Klir G.J. & Folger T.A. "Fuzzy sets, uncertainty and Information", Prentice-Hall of India vt. Ltd., 1993.
2. Zimmerman H.J. "Fuzzy set theory-and its Applications", - Kluwer Academic Publishers, 1994
3. Driankov, Hellendroon, "Introduction to Fuzzy Control", Narosa Publishers.