III SEMESTER B.TECH. (E&E)

MA 1303 (EC, EE, IE, ME) **Credit: 4 (L-3, T-1, P-0)**

ENGINEERING MATHEMATICS III

Questions to be set: Eight (Four from each unit)
Questions to be answered: Any five selecting at least two from each unit.

OBJECTIVE: The objective of this paper is to give some concept about topics like Fourier analysis, Partial Differential equations (PDE), Vector calculus and Numerical Methods. All these topics are very helpful for engineering studies. The concept of gradient, divergence, curl and PDE are required for study of Fluid Mechanics. Fourier series is used to approximate the periodic functions, Fourier transform is used to solve differential equations. In higher studies, to get analytical solution for mathematical problem like integration, system of linear equations (with large number of variables) are not always possible or not so easy. So numerical methods are helpful to solve.

Pre-requisites: Basic concept of vectors, coordinate geometry, calculus, multiple integral, ordinary differential equations, linear algebra.

UNIT I

Fourier analysis

Periodic functions, Trigonometric Series, Fourier series, Fourier series of odd and even functions, functions with arbitrary period, half range expansion, Fourier integrals, Fourier transforms, Fourier sine and cosine transforms, Convolution theorem(statement only).

Application of Fourier series to forced vibration problems, Application of Fourier integral and Fourier transform to solve heat equation.

Partial differential equations

Definition, degree, order of a PDE. Formation of PDE. Linear and nonlinear PDE. Solution of first order linear PDE, Lagrange's method. Solution of first order Nonlinear PDE, Charpit's method. Solution of higher order PDE by direct integration. Solution of higher order linear PDE with constant coefficients, homogeneous and nonhomogeneous.

Derivations of one dimensional wave equation (vibrating string) and its solutions by using method of separation of variables. Simple problems. D ' Alembart's solution of' wave equation. Derivation of one dimensional heat equation and its solution by using method of separation of variables. Solution of 2D-Laplace's equation.

UNIT II

Vector calculus

Vector-calculus-gradient, divergence and curl, their physical meaning and identities. Line, surface and volume integrals. Simple .problems- Green's theorem - statements of divergence and Stoke's theorems - Simple applications. Curvilinear Co-ordinates.

Numerical Analysis I

Interpolation and application : finite difference, central and divided differences, Newton - Gregory and Lagrange's interpolation formulae.Inverse interpolation. Numerical differentiation. Numerical integration: Trapezoidal rule, Simpson's one third and three eight ruleSolution of systems of linear equation: Jacobi, Gauss- Seidal and relaxation methods. Solution of tridiagonal systems. Eigen values and eigen vectors of matrices and elementary properties, computation of largest eigen value by power method. numerical evaluation of Fourier coefficient, difference equations with constant coefficient and their solution.

Text books: .

C. E. Weatherburn : Vector Analysis

2. Erwin Kreyszig : Advanced Engineering Mathematics
3. S.S. Sastry: Introductory methods of numerical analysis
4. I. Sneddon, Elements of Partial Differential Equations

References;

M. K. Jain and S.R.K. Iyengar and R. K. Jain: Numerical methods for scientific and engineering computations.

Murray R. Spigel : Vector Analysis, Schaum's Outline Series

III SEMESTER B.TECH. (E&E)

EE1302 **4 HRS./WEEK**

CIRCUITS & NETWORKS

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Network theorems: Linearity and superposition Theorem, Thevenin's Theorem, Maximum power transfer theorem, Norton's Theorem, Reciprocity Theorem, Millman's Theorem. (A.C. & D.C.)
Resonance-series and parallel, Half power frequencies, quality factor, Band width, Impedance,Admittance and current locus for series and parallel circuits, current at resonance from locus diagram
Time Domain Analysis Of First And Second Order Circuits: Introduction, source free RC and RL circuits, Response of the first order circuit for different type of excitation like step,impulse,sinusoidal and exponential, Time constant, Concept.
Source free RLC Series and Parallel circuit, Impulse and Step response of Series and Parallel RLC circuits, Setting time, rise time, Maximum overshoot.

Network Topology
Graph of a network, Concept of tree and cotree, incidence matrix, tie set and cutest, Formulation of equibilirium equation in matrix form, Principle of duality, Tellegen's Theorem.

UNIT-II

Two port network:
z,y,t,h parameters, Condition of reciprocal and symmetry for the z,y,t,h parameters, Interrelationship between parameters, connection of two port network [20 Hrs.]

Network Functions:
Driving point and Transfer function, Poles and Zeroes and its significance.

Synthesis:
Hurwitz polynomials, Concept of positive real functions and testing procedures for realness.
Synthesis of one port LC, RL, RC Networks by Foster and cauer methods. Zeroes of transmission, Realization of RC and LC ladder lattice Networks. [14 Hrs.]

RECOMMENDED BOOKS:

1 Circuit Theory by AChakraborti, Dhanpat Rai Publications
2 Basic Circuit Theory by Charles A. Deosar& Ernest S.Kuh (McGraw hill international edition)
3 Network Theory And Filter Design by V.K Aatre (new age publication)
4 Introduction to Modern Network Synthesis by Van Valkenburg (PHI publication)
5 Circuit Analysis by T .S.K.V .Iyer (TMH publication)
6 Network Analyses by Van Valkenburg (PHI Publication)
7 Network Analysis and Synthesis by F.F.Kuo John Wiley &sons

III SEMESTER B.TECH. (E&E)

EE1303 **4HRS./WEEK**

ELECTRICAL MACHINES – I

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

Unit-I

Magnetic circuits applied to electrical machines- self inductance, mutual inductance and leakage inductance.

Transformers: Review of Construction, ratings & specification of X'mer, Principle of operation of single phase transformer, phasor diagram (no-load and on-load). Development of equivalent circuit, O.C and S.C tests, Voltage regulation, losses and efficiency, All-day efficiency, three phase transformers and different connections: Vector Grouping: Star-star, Star-delta, Delta-star, Delta-Delta, Scott connection, Open delta connection, 3-phase to 6-phase conversion: Double star, double delta and diametrical connection, Polarity test, Sumpner's test. Parallel operation of single phase and three phase transformers, ON-and OFF-load tap changers, Autotransformers.

Unit-II

Energy conversion principles in rotating electrical machines.

DC Generators: Construction, principle of operation, Methods of excitation, armature reaction, commutation, characteristics of DC generators-OCC and external characteristics.

DC Motors: Principle of operation, characteristics of motors, different types of D.C. motor (shunt & series & compound).

Field and armature methods of speed control, principle of DC motor starting, 3 & 4 point starters.

Losses and Efficiency of DC machines, Swinburne's test, Hopkinson's test, Retardation test, Field's test.

RECOMMENDED BOOKS:

1. Clayton and Hankock – Performance and Design of DC Machines – Oxford IBH, 1994.

2. Nagrath and Kothari – Electrical Machines TMH, 1993.

3. Bhimbra – Electrical Machinery (Ed. 4) – Khanna Pub, 1986.

4. M.G. Say – AC. Machines (Ed.5) – Pitman, 1993.

5. P.K. Mukherjee & S. Chakravorti – Electrical Machines (Ed.2) – Dhanpat Rai, 1993

III SEMESTER B.TECH. (E & E)

EE 1308 MEASUREMENT AND INSTRUMENTATION 4 HRS./WEEK

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Units of measurement- the fundamental units of SI, derived units, conversion factors. Errors- definition; types of errors in measurement (with examples).

Basic electromechanical indicating instruments- the D'Arsonval Galvanometer, principle of operation and use as an ammeter and voltmeter. Basic idea about instruments with non-linear response- moving iron type, electrodynamometer- as ammeter, voltmeter, wattmeter, multimeter and energy meter; rectifier-type instrument. Single-phase and three-phase energy meters. Digital voltmeters and multimeters.

Measurement of resistance- classification of resistance; wheatstone bridge (W.B.), limitations of W.B., Kelvin's double bridge. Concept of earth resistance and its measurement; Megger. AC Bridges- Maxwell's bridge, Maxwell-Wein bridge, Anderson's bridge, Schering bridge, Desauty bridge.

Potentiometer- introduction and types; theory, operation and applications of student's type, Brook's deflection type, co-ordinate and polar-type potentiometers.
Instrument transformers- current transformer (CT) and potential transformer (PT); construction and operation for metering and protection applications; Silsbee's method.

UNIT-II

Transducers- introduction and classification. Strain gauges, force-summing members such as diaphragms, bourdon tubes and piezo- electric devices. Hall-Effect transducers. Temperature sensors- resistance-type temperature sensors esp. platinum resistance thermometer, thermistors and thermocouple- properties, materials used for construction, reference junction compensation of thermocouples. Current, voltage, and torque transducers.
Introduction to signal conditioning- OP-AMPs as signal conditioners; its application as a buffer amplifier, and in analog-to-digital converter's (ADCs) and digital-to-analog converters (DACs). Dual slope ADC, successive- approximation ADC, flash-type ADC. Digital frequency meters.

Cathode ray tube (CRT)- construction, working and general applications. Measurement of voltage, current, phase and frequency (using Lissajous patterns) on a CRO.

Wave analyzer- introduction and qualitative treatment of frequency selective wave analyzer and heterodyne wave analyzer; discussions on basic spectrum analyzer. Data acquisition system, including the concept of virtual instrumentation.

RECOMMENDED BOOKS:

1. Cooper W. O. and Helfrick A. D. - Modern Electronic Instrumentation and Measurement Techniques.
2. Ramakant S. Gayakwad- Op-Amps and Linear ICs.
3. Anand Kumar- Fundamentals of Digital Electronics.
4. A. K. Sawhney - A course in electrical and electronic Measurements and Instrumentation.
5. E.W. Golding & F.C. Widdis - Electrical Measurements and Measuring Instruments.

III SEMESTER B.TECH. (E & E)

EE1305 **4 HRS/WEEK**

DIGITAL ELECTRONICS

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

NUMBER SYSTEM AND CODES

Review of Binary number systems, Number systems and codes: Binary to decimal conversion, decimal to binary conversion, octaL and hexadecimal numbers, ASCII code, Excess-3 code, gray code, arithmetic codes: Binary addition, hexadecimal arithmetic, binary subtraction, unsigned binary numbers, 2's complement arithmetic,

LOGIC CIRCUITS & LOGIC FAMILIES

OR, AND, NOT, NOR and NAND gates, truthtables, Boolean algebra, DE Morgan's theorems, Sum of products, product of sums (Minterm& max- terms), function minimisation using Karnaugh's map, Don't care conditions, variable entered mapping, minimisation using variable entered maps.
TTL circuits, Tri-state TTL devices, positive and Negative logic, CMOS circuits, Transfer characteristics, Fan out, Fan in, Propagation delay, noise margin, TTL and CMOS interfacing.

UNIT-II

COMBINATORIAL CIRCUITS

Arithmetic building block, half adder, full adder, adder, subtractor, carry look ahead adder.
Data processing circuits: Multiplexes, demultiplexers, decoders 1 to 16 decoder, BCD-decimal decoder, seven segment decoder, encoder, parity generators, parity checkers, ROM, PAL.

SEQUENTIAL CIRCUITS

Flip flops: Memory element, LATCH, SR, Dand JK flip flops, excitation tables.
Shift registers: Serial in - Serial out, parallel in – parallel out shift registers, ring counter.
Counters: Asynchronous, synchronous, Mod-3, Mod-5, Preset table, shift counters, Mod-10 shift counters.
Semiconductor memories: Memory addressing, ROMS, PROMS, EPROMS, RAMS, DRAMS, memory cell.

RECOMMENDED BOOKS:

Donald P leach & Albert Paul Malvino-Digital Principles and Applications (Ed.4)-TMH, 1991.
2. Douglas V. Hall - Digital circuits and Systems -MGH, 1989.
3. William I. Fletcher- Engineering Approach to Digital Design PH I, 1990.
4. Taub& Schilling – Digital Integrated Electronics-MGH, 1977.

III SEMESTER B.TECH. (E&E)

EE1306 **4 HRS.\WEEK**

ANALOG ELECTRONIC CIRCUITS

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT -I

Review of Semiconductor physics.
P-N Junction - Open circuited P-N Junction, Bias conditions, The current components in a P-N Junction diode. The volt-ampere characteristics, Reverse saturation current, Breakdown. The effect of temperature on V-I characteristics, Diode resistance, Transition capacitance, Diffusion capacitance, Switching lines, Zener diodes, Semiconductor photo -diode, Light emitting diode, specifications. .
Diode circuits- Diode as a circuit element, load-line concept, diode model, clipping circuits, clipping at two independent levels, clamping circuits.
Transistor Characteristics- Bipolar Junction Transistor, Bias conditions, Transistor current components common base configuration, Transistor amplifying action, Transistor as a switch, common emitter configuration, common collector configuration, Maximum voltage rating, Limits of operation, Transistor specifications.
Biasing and stabilization against variation in I_{CO},V_{BE} and β.
Fundamentals of Insulated Gate Bipolar Transistor (IGBT)
Small signal model (H-parameter model) -comparison and applications of the CE, CB, CC configuration (with CE hybrid model only). Cascade connections, Darlington configuration, current sources and current mirror circuits (using Transistor only).

UNIT –II

Field Effect Transistors - Characteristics of FETs, Transfer characteristics, specification, Depletion type MOSFET, Enhancement type MOSFET, VMOS, CMOS, FET and MOSFET biasing,
Rectifier and Power supplies - voltage regulation, shunt voltage regulator, IC. Voltage regulators
Amplifiers -Classification of amplifiers, Distortion in amplifiers, Frequency response ofan amplifier, Polar- plots, gain bandwidth product.
Large Signal Amplifiers (Class A, Class B and Class AB) - Transformer coupled amplifier, Thermal runaway, Theoretical deficiency, Distortion analysis, complementary and quasi complementary push-pull amplifier.

RECOMMENDED BOOKS:

1. Millman and Halkias - Integrated Electronics : Analog and Digital circuits and systems-TMH-1992
2. Boylestad and Nashelsky - Electronic Devices and Circuit Theory (Ed. 5. -PHI, 1993.

III SEMESTER B.TECH. (E&E)

EE1361 **3 HRS.\WEEK**

ELECTRIC CIRCUITS & PSPICE LAB

1. To verify Norton's theorem both through simulation in Pspice environment and hardware setup .
2. To verify Thevenin's theorem both through simulation in Pspice environment and hardware setup.
3. To verify Superposition theorem both through simulation in Pspice environment and hardware setup.
4. To verify Maximum power theorem both through simulation in Pspice environment and hardware setup
5. To verify Reciprocity theorem both through simulation in Pspice environment and hardware setup.
6. Series RLC resonance.
7. Parallel RLC resonance.
8. Measurement of 3-Phase power using two watt meter method.
9. Measurement of inductance.

Extra Experiments (beyond course curriculum)

10. Transient response of RL circuit both through simulation in Pspice environment and hardware setup.
11. Transient response of RC circuit both through simulation in Pspice environment and hardware setup.
12. Source free RC circuit both through simulation in Pspice environment and hardware setup.
13. Study of RLC circuit and determination of time constant, damping factor mathematically and graphically for different damping cases.

III SEMESTER B. TECH (E&E)

EE1362 **3 HRS. /WEEK**

BASIC ELECTRONICS LAB

FIRST CYCLE

1. Diode characteristics – Silicon and Zener diode.

2. BJT characteristics.

3. JFET characteristics.

4. Diode applications – clipping and clamping.

5. Full-wave bridge rectifier with capacitor filter.

6. Regulated power supply using Zener, 78XX and 79XX and LM317.

7. Transistor circuits – as switch, as amplifier, as level shifter, as inverter and buffer.

8. Design a Two stage RC coupled amplifier.

9. MOSFET circuits-MOSFET biasing, totem pole configuration.

Extra Experiment (beyond course curriculum)

10. IGBT characteristics

SECOND CYCLE

11. Characteristics of Logic Gates (AND, NAND, XOR, ORetc)

12. To implement Full-Adder circuit using 3:8 Decoder by the help of AND gate.

13. To Implement 2:4 Decoder using NAND gate.

14. Design a even 3- bit parity checker and even 3-bit parity generator using logic gates.

15. Design and verify half sub tractor and full subs tractor circuit using logic gates.

16. Design and verify BCD to 7- segment decoder using IC 7447.

Extra Experiment (beyond course curriculum)

17. Generation and Design of “Digital Clock”.

III SEMESTER B.TECH. (E & E)

PROGRAMMING WITH C++LAB

EE1364 **3 HRS. /WEEK**

CONTENTS

MODULE – 1	**SIMPLE C++PROGRAMS**
MODULE – 2	**FUNCTIONS AND ARRAYS**
MODULE – 3	**USE OF CLASS AND FUNCTIONS**
MODULE – 4	**OPERATOR VOERLOADING**
MODULE – 5	**INHERITANCE AND POLYMORPHISM**

ELECTRO TECHNOLOGY LAB

Subject Code : EE 1364
Number of contact Hrs. per week : 03 Hrs.

DC machine: Construction, principle of operation, EMF & torque equation, types, characteristics, starting and speed control of DC motor.

Basic operation amplifier, block diagram of typical op amp, characteristics of an ideal op amp, input offset voltage & current, CMMR, slew rate, feed back in operational amplifier circuit, closed loop voltage gain, application as inverting and non-inverting amplifier, voltage follower, summing amplifier, difference amplifier, and comparator.

Thyristor: Members of thyristor family, SCR, two transistor analogy of SCR, V – I characteristics of SCR, triggering methods, SCR ratings, turn on and turn off mechanisms, commutation of SCR, power control using SCR, average and RMS values of load voltage and current, application of SCR in motor speed control, light dimming control, heater control, inverters, Triac, operation, V-I characteristics, application. **Introduction to Control System**, open loop and closed loop controls, transfer function, block diagram s of control system.

List of experiments:-

1. No load speed characteristics of DC shunt motor
2. Load test on DC shunt motor
3. OCC of DC generator
4. External characteristics of DC generator
5. OP AMP amplifications
6. V-I characteristics of SCR
7. V-I characteristics of Triac
8. Commutation of SCR
9. Motor control with SCR and Triac
10. Study of single phase half controlled converter
11. Study of single phase full controlled converter

Text books:

1. **I J Nagrathand D P Kothari:** Electric Machines, Tata McGraw Hill
2. **Albert Paul Malvino:** Electronic Principles (Third Edition), Tata McGraw Hill
3. **K Ogata:** Modern Control Engineering (Second Edition), Prentice Hall of India
4. **C L Wadhawa:** Generation, distribution and utilization of electrical energy,Wiley Eastern

ELECTRO TECHNOLOGY

Subject Code : EE1307
Number of Lecture Hrs per week : 04 Hrs.
Questions to be set : 4 from each unit
Questions to be answered : 5 selecting at least 2 from each unit

UNIT I

DC machine: Construction, principle of operation, EMF & torque equation, types, characteristics, starting and speed control of DC motor.

Electric heating: Advantages of electric heating, classification of heating methods, transfer of heat, calculation of quantities of heat, core type induction furnace, resistance heating, designing of heating elements, dielectric heating.

Basic operation amplifier, block diagram of typical op amp, characteristics of an ideal op amp, input offset voltage & current, CMMR, slew rate, feed back in operational amplifier circuit, closed loop voltage gain, application as inverting and non-inverting amplifier, voltage follower, summing amplifier, difference amplifier, comparator.

Thyristor: Members of thyristor family, SCR, two transistor analogy of SCR, V – I characteristics of SCR, triggering methods, SCR ratings, turn on and turn off mechanisms, commutation of SCR, power control using SCR, average and RMS values of load voltage and current, application of SCR in motor speed control, light dimming control, heater control, inverters, Triac, operation, V-I characteristics, application. (24L)

UNIT II

Introduction to Control System, open loop and closed loop controls, transfer function, block diagram s of control system.
Mathematical Models of physical systems: differential equations of physical systems, transfer function analysis, mechanical, translational and rotational systems, electrical systems, hydraulic systems, pneumatic systems, thermal systems and electromagnetic systems.
Standard test signals, types and order of a system, time response of first and second order systems, time response specification.
Stability: Necessary conditions for stability, Routh-Hurwitz stability criterion, Routh's test – difficulties and remedies, relative stability.
Proportional, PI and PID controllers.
(24L)

Text books:

1. **I J Nagrathand D P Kothari:** Electric Machines, Tata McGraw Hill
2. **Albert Paul Malvino:** Electronic Principles (Third Edition), Tata McGraw Hill
3. **K Ogata:** Modern Control Engineering (Second Edition), Prentice Hall of India
4. **C L Wadhawa:** Generation, distribution and utilization of electrical energy,Wiley Eastern

MA 1403(EE, IE) **Credit: 4 (L-3, T-1, P-0)**

ENGINEERING MATHEMATICS IV

Questions to be set: Eight (Four from each unit)
Questions to be answered: Any five selecting at least two from each unit.

Objective: The objective of teaching this paper is to apply the Fourier transform in solving integration, one-dimensional heat equation and in digital signal and image processing. The objective of teaching probability is to provide some basic idea on Probability and its applications in the field of Science and Engineering. It has lot of applications in Digital Communications & Modeling of physical problems.
Numerical analysis has numerous applications in all fields of science and engineering, and essentially any type of work that requires calculations to give very precise solutions.
Complex numbers are applied to study control theory, signal analysis, electromagnetism and electrical engineering etc.
The Z transform is used in many applications of mathematics and in signal processing.
Pre-requisites: Some prior knowledge of integral calculus, differential equation, matrices are required

UNIT I

Probability Theory

Finite sample space, conditional probability and independency, Baye's theorem, one dimensional random variable, mean, variance and expectation, Chebyschev's inequality.
Two and higher dimensional random variables, covariance, correlation coefficients, least squares principle of curve fitting.
Distributions : Binomial, Poission, Uniform, Normal, Gamma, Chi square and exponential, simple problems.

Numerical Analysis II

Numerical solution of algebraic and transcendental equations using Newton Rapson's method, Solution of nonlinear equation by Newton Rapson's method, Numerical solution of initial value problems in ordinary differential equations by Taylor series method, R- K Method.

UNIT II

Complex Variables

Introduction -complex numbers, functions, continuity, differentiability, analyticity -Cauchy Riemann equations and properties of ana1ytic functions. Line integrals in complex plane and basic properties of Cauchy's integral theorem and Cauchy's integral formula -derivatives of analytic functions.Taylor, Maclaurin and Laurent's series, residue theorem, evaluation of standard real integrals using contour integrals.

Application of Fourier and Z Transform

Parseval's identity of Fourier transforms, Solution of boundary value problems using Fourier transforms, Z transforms, Solution of difference equation using Z transforms.

Text books :

1. P.L. Meyer : Introduction to Probability and Statistical Applications.
2. S.S. Sastry : Introductory methods of numerical analysis
3. Erwin Kreyszig : Advanced Engineering Mathematics
4. A.V. Opponheim : Digital signal processing
5. R. V. Churchill and J. W. Brown : Complex variables and applications

References :

Hogg and Craig : Introduction to Mathematical Statistics
2. S.M. Ross: introduction to probability and statistics for engineers and scientists.
3. K.S. Trivedy : Introduction to probability and statistics and queuing theory.
4. M.K. Jain and S.R.K. Iyengar and R.K. Jain : Numerical methods for scientific and engineering computations
5. Murray R. Spigel : Complex variable, Schaum Outline Series

IV SEMESTER B.TECH. (E & E)

EE1402 **4 HRS./WEEK**

SIGNALS & SYSTEMS

No. of questions to be set: 8 (Four from each unit)

No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Introduction: Definitions of signal and systems, Classification of signals, Basic operations on signals, Elementary signals, Energy and Power signals , Interconnection of system and Properties of systems.

Lapace Transform: Introduction, Properties, Inverse of Laplace transform, Application in solving circuits problems and Differential equation.

Time-domain Representations for Linear Time Invariant (LTI) Systems: Convolution, Impulse response representation, Convolution Sum and Convolution Integral. Properties of impulse response representation, Differential and difference equation Representations and Block diagram representations.

Fourier Representation for Signals: Introduction, Discrete time and Continuous time Fourier series (derivation of series excluded) and their Properties. Discrete and continuous Fourier series (derivations of transforms are excluded) and their properties.

UNIT-II

Applications of Fourier representations: Introduction, Frequency response of LTI systems, Fourier series representation of periodic signals and Fourier Transform representation of discrete time signals.

Z-Transforms: Introduction, Z – transform, Properties of ROC, Properties of Z – transforms, Inversion of Z – transforms. Modified Z- transform, Transform analysis of LTI Systems, unilateral Z Transform and its application to solve difference equations.

Analog Filter Design: Classification of filters, Design of Butterworth, Chebyshev, Elliptical

LPF, inverse Chebyshev filter, Bessel function, Comparison of analog filters and Frequency transformation.

RECOMMENDED BOOKS:

1 Signal & System by Haykin Van Veen (John Wiley and Sons)

2 Signal & System by I.J.Nagrath,S.N. Sharan ,R Ranjan (TMH)

3. Signal and System by D .k Cheng

4. Digital Filter Analysis, Design, and Application by Andrews Antononiu (TMH)

IV SEMESTER B.TECH. (E & E)

EE1403 **4 HRS./WEEK**

ELECTRICAL MACHINES-II

No. of questions to be set: 8 (Four from each unit)

No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Three Phase Induction Motors: Review of construction and principle of operation of three phase induction motor, Development of equivalent circuit. Torque equation, Torque-slip characteristics, No load and blocked rotor tests, Starters, Double cage and Deep bar motors. Cogging and crawling. Operation of Induction motor as induction generator. Single Phase Induction Motors - Principle of operation and Starting methods.

Special Machines - Permanent magnet motors, Brushless d.c. motor, Switched reluctance motor, and Stepper motors.

UNIT-II

Synchronous Generators: Constructional features, EMF equation, Winding factors, Armature reaction. Leakage reactance, Synchronous impedance, Equivalent circuit. Phasor diagram, Voltage regulation by EMF, MMF, ZPF and ASA methods, Two reaction field theory and Phasor diagram for salient pole machines and slip test. Expressions for power developed and Power input.

Synchronization: Synchronizing power and torque, Parallel operation of two alternators and load sharing, Effects of constant input and variable excitation, Constant excitation and variable input, Alternators on infinite bus, V-curves.

Synchronous motors: Construction, Principle of operation, V-curves, Hunting. Starting methods and Synchronous condenser.

RECOMMENDED BOOKS:

1. Langsdorf A. - Theory of AC Machinery- TMH, 1994.
2. Lawrence and Richards- Principles of AC Machinery (ED. 4.)- MGH. 1953.
3. M.G. Say- AC Machines (ED. 5)- Pitmam, 1983.
4. Nagrath and Kothari-Electrical Machines- TMH, *1093.*
5. Bhimbra- Electrical Machinery (ED. 4)- Khanns Pub. 1986.
6. P.K. Mukherjee and S. Chakravorti- Electrical Machines (ED. 2)- Dhanpat Rai. 1993.

IV SEMESTER B.TECH. (E & E)

EE1407 **ELECTROMAGNETIC THEORY** **4 HRS/WEEK**

No. of questions to be set: 8 (Four from each unit)

No. of questions to be answered: 5 (Minimum of two questions from each unit)

Pre-requisites: Nil

UNIT I

The Co-ordinate Systems and revision of vector calculus- Electrostatics: Electric Flux and Flux Density; Gauss's law -Energy and Potential. - Capacitors and Capacitances- Method of Images. Steady Electric Currents: -The Equation of Continuity. Joules law- Magnetostatics: The Biot-Savart law. Amperes' Force Law - Magnetic Vector Potential.- Ampere's Circuital law.

Faraday's Law of Induction; Self and Mutual inductance. Maxwell's Equations from Ampere's and Gauss's Laws. Maxwell's Equations in Differential and Integral forms; Equation of Continuity. Concept of Displacement Current. Electromagnetic Boundary Conditions - Poynting's Theorem, Time – Harmonic EM Fields. Maxwell stress tensors.

UNIT II

Plane wave Propagation: Helmholtz wave Equation-Plane wave solution.-Plane wave propagation in lossless and lossy dielectric medium and conducting medium. Polarization of EM wave - Linear, Circular and Elliptical polarization. Boundary Conditions

Transmission Lines. LCR ladder model for transmission lines. The transmission line equation. - Solution for lossless lines. Wave velocity and wave impedence. Reflection and Transmission coeffcients at junctions. VSWR. Introduction to electromagnetic interference and compatibility

RECOMMENDED BOOKS:

1. Cheng, D.K., "Field and Wave Electromagnatics", Pearson Education (Singapore) Pte. Ltd., 2nd Edn., 1989.
2. Hayt, W.H., J.A. Buck, "Engineering Electromagnetics", Tata Mc Graw Hill.
3. Edward C. Jordan & Keith G. Balmain, "Electro-magnetic waves & Radiating System", PHI.
4. Deepak Sood, "Field & Wave, A Fundamental Approach", University Science Press.
5. S. C. Matapatra, Sudipta Mahapatra, "Principles of Electromagnetics", Tata McGraw Hill.
6. Matthew Sadiku, "Principles of Electromagnetics", Oxford University Press.
7. A.R. Harish, M. Sachidananda, "Antennas & Wave Propagation", Oxford University Press.

EE1405 **4HRS/WEEK**

GENERATION, TRANSMISSION & DISTRIBUTION OF ELECTRICAL POWER

No. of questions to be set: 8 (Four from each unit)

No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Types of generation: Conventional and Non-conventional, Thermal Power Plant, Hydro Power Plant, Gas Power Plant, Nuclear Power Plant, Costing and comparision, Co-generation and Various sources of Non-Conventional Energy Sources.

AC Transmission: Typical AC transmission and distribution scheme, Standard Voltages- Advantages and limitation of AC high voltage transmission, Feeders, Distributors end service mains- Effect of working voltage on feeders and distributors, IE rules regarding permitted voltage variation, Selection of ACSR conductor size by voltage drop method, Kelvin's law, Merits and Demerits.

Line Parameters: Calculation of inductance and capacitance of single phase line and three phase lines with symmetrical and unsymmetrical spacing, Transposition, GMD, GMR and their applications in the inductance and capacitance calculations.

Line Performance: Short and medium lines, Nominal T & PI models, Rigorous solution for long lines, ABCD constants, Equivalent T and PI circuits and Regulated system of transmission by reactive power control.

UNIT-II

Corona: Phenomenon, Critical voltages, Factors affecting corona and Corona loss.

Underground Cable: Insulating Materials used - PVC, Paper, XLPE comparison, Constructional features of cables PVC, Paper insulated, XLPE, Electrostatic stress, Capacitance and insulation resistance of single core cables and Capacitance of 3- core cables.

Mechanical Characteristics of Overhead (OH) lines: Sag calculations in conductor's level supports and supports at different levels, Effect of wind and ice, Tension and sag at erection and Stringing chart.

Insulators: Types, Constructional features, Potential distribution in a string of suspension insulators, Methods of equalizing the potential, String efficiency and Testing of insulators.

RECOMMENDED BOOKS:

1. Chakraborti, Soni Gupta Bhatnagar - A Text Book of Power System Engineering – Dhanpat Rai & Co.
2. S.N. Singh - Electric Power Generation, Transmission & Distribution – Prentice Hall of India (PHI).
3. Nagrath and Kothari - Power System Engineering- TMH, 1994.
4. C.L. Wadhva- Electrical Power System (Ed. 2) - Wiley Eastern, 1993.
5. T.S.M. Rao - Principal and Practice of Electric Power Transfer System- Khanna,1974.

EE1406 **4 HRS./WEEK**

ANALOG SYSTEMS DESIGN

No. of questions to be set: 8 (Four from each unit)

No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Feedback Amplifiers: Classification, Concepts, Feedback amplifier topologies. Properties of negative feedback amplifier, Classifications, (Voltage series, Voltage shunt, Current series, Current shunt), Properties of negative feedback amplifiers, Effect of feedback on R_i, R_o and bandwidth. Advantages of negative feedback.

Oscillators: R-C, Phase-Shift, Wein bridge using operational amplifier, Crystal oscillators.

Operation Amplifier: Architecture, Two-stage architecture, Gain stage with active load, Small signal model the differential stage, D.C. level shifting, Current mirror, Offset voltage and current, CMRR frequency response, Compensation, Bandwidth consideration, Offset voltage and current and Slew rate limitations.

UNIT-II

OPAMP Applications: Inverting, Non-inverting amplifier, Voltage follower, Integrator, Differentiator, Summing amplifier, Differential amplifier, Phase shifter, Voltage to Current converter, Active filters-Low pass, High pass, Band pass, Band reject and All pass filters. (Butterworth)

Non-Linear Applications of OPAMPS- Comparator, Schmitt Trigger, Stable multivibrator, Monostable multivibrator, Triangular wave generator, Precision rectifier, Peak detector, Zero crossing detector, Square wave generator, Ramp generator, V/f and f/V

Other Linear IC: 555 Timer, Architecture, Applications, (Astable multivibrator, Monostable multivibrator, Schmitt trigger ramp generator), Phase locked loops and Voltage controlled oscillators.

RECOMMENDED BOOKS:

. 1. Jacob Millman and Arvin Grabel-Micro Electronics (Ed.2)-MGH,1988.

2. Ramakant Gayakwad- OP Amps and Linear Integrated Circuits (ED.2)-PHI, 1992.

3. Sergio Franko- Design with Operational Amplifiers and Analog Integrated Circuits-MGH,1988.

4. Robert F .Coughlin and Frederick S. Driscoll- Operational Amplifiers and Linear Integrated Circuits (Ed.3)-PHI, 1987.

5. Sedra and Smith- MicroElectronics Circuits (ED.2) -Holt Rinehart & Winston, 1987.

V SEMESTER B.TECH. (E & E)

EE1461 **3 HRS./WEEK**

ELECTRICAL MACHINES LABORATORY-I

1. Open circuit and Short Circuit Test on a Single Phase Transformer
2. Sumpner's Test on a Single Phase Transformer
3. Open Delta of Three Phase Transformer
4. Load Characteristic of DC Shunt Motor
5. Load Test on DC Series Motor
6. Load Test on DC Shunt Generator
7. Open Circuit Characteristic of a DC Generator
8. Speed Control of DC Shunt Motor
9. Hopkinson's Test (Regenerative Test)
10. Swinburne's Test

EE1462 **3 HRS./WEEK**

ANALOG & DIGITAL ELECTRONICS LAB

FIRST CYCLE: ANALOG SYSTEM DESIGN

1. Design of adder circuit using OP-AMP.
2. OP-AMP as an integrator & differentiator.
3. Design a current to voltage and voltage to current converter using OP-AMP.
4. Design a Comparator circuit using OP-AMP-741 to compare between two Input.
5. Design a triangular wave generator using OP-AMP.
6. Design a Monostable and Astable Multivibrator using 555 Timer.
7. Design of a 1^{st} order and 2^{nd} order Low-Pass filter using OP-AMP with cutoff frequency at 1 KHz & pass band gain 2.

Extra Experiment (beyond course curriculum)

8. Design of a 1^{st} order and 2^{nd} order High-Pass filter using OP-AMP with cutoff frequency at 1 KHz & pass band gain 1.58.

SECOND CYCLE: DIGITAL SYSTEM DESIGN

1. To implement and verify BCD to XS-3 code converter.
2. Implementation of R-S, J-K, D Flip-Flop.
3. To implement a 3 bit MOD – 6 Synchronous Counter.
4. Design a 3 bit Ring Counter & Twisted Ring Counter by the help of Synchronous circuit Design.
5. To implement a 3 bit MOD – 6 Asynchronous Counter

Extra Experiment (beyond course curriculum)

6. Design a 3 bit UP- DOWN counter with the help controlling Signal X. If X=1 It will count upward direction and if X =0 count downward direction.

EE1463 MEASUREMENT AND INSTRUMENTATION LAB 3 HRS./WEEK

1. Measurement of inductance by

(a) Maxwell Inductance Capacitance Bridge and

(b) Andersons Bridge.

2. Measurement of capacitance by Schering Bridge.

3. (a) Measurement of medium resistance (Wheatstone bridge).

(b) Measurement of low resistance (Kelvin double bridge).

4. Adjustment and calibration of single phase energy meter.

5. Adjustment and calibration of three phase energy meter.

6. ADC-Measurement of conversion time and quantization error.

7. DAC- Unipolar and bipolar connections, measurement of accuracy.

8. To measure the voltage using Piezo-electric transducer.

9. To measure pressure in terms of voltage using a pressure transducer module.

10. Measurements using ordinary dual trace oscilloscope

11. To measure the Young's modulus using Cantilever beam demonstration instrument and also implement in Lab View.

12. To measure the Hall voltage and current using Hall Effect Transducer trainer.

Extra Experiment (beyond course curriculum)

13. Measurement of unknown frequency by Broken Ring Method.

14. C.T Test by Sillbie's method- error measurement.

15. Measurements using ordinary dual trace oscilloscope

16. To measure the unknown voltage of test circuit using Crompton potentiometer

V SEMESTER B.TECH (E & E)

EE1501 **4 HRS/WEEK**

POWER ELECTRONICS

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Silicon Controlled Rectifiers (SCR): Basic structure, Equivalent circuit, Operation. V-I characteristics, turn-on, turn-off mechanisms, gate characteristics, gate drive requirements, firing circuits, di/dt, dv/dt and overload protection, committing circuits: Resonant commutation, complementary commutation, auxiliary commutation, calculation of committing components, series- parallel connection of SCRs, causes for unequal distribution of voltages and currents, string efficiency, static and dynamic equalization circuits.

Other Power Semiconductor Devices: Triac, Power MOSFET, IGBT – Basic structure, Equivalent circuit, operation, terminal characteristics, safe operating area (SOA), device rating. Base/Gate drive requirements, typical drive circuit with short circuit protection, turn on and turn off snubbers and their design.

Single phase converters: Half wave, bridge converters, operation with RL and back emf loads, performance with free wheeling diode, full wave controlled bridge rectifier with controlled free wheeling, effect of source inductance.

Three Phase converters : Trigging sequence, semi controlled and fully controlled three-phase converters.

Dual converters: Single phase and three dual converters, mode of operation –circulating and non circulating. Circulating current.

AC regulators: Single-phase AC voltage regulators.

UNIT –II

DC-DC Converters: Basic principle of time ratio control, constant and variable frequency, Step down and step up chopper, classification of choppers. Multiphase choppers.

DC-AC Converters: Single phase and three phase bridge inverters, square wave operation, 120 and 180 degree modes, potential diagrams. Qualitative treatment of line commutated inverters.

PWM Inverters: Voltage control, Unipolar and Bipolar voltage switching, Harmonic reduction.

PWM Technique: Current regulated (Hysteresis) Modulation, Selective harmonic elimination, sine triangular modulation, linear modulation. over modulation, Harmonics in the output voltage, stair case PWM, space vector modulator.

RECOMMENDED BOOKS:

1. Rashid - Power Electronics- Circuits, Devices and Applications – PHI.

2. Mohan, TM Undeland, W. P. Robbins – Power Electronics - John wiley and Sons (SEA).

3. VedamSubramaniam- Power Electronics -New Age International Publications.

V SEMESTER B.TECH. (E & E)

EE1502 **4 HRS./WEEK**

LINEAR CONTROL SYSTEMS

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Introduction to Control systems, Classification, comparison of open-loop and closed-loop systems, Representation of control systems by block diagrams, Mathematical models of electrical, mechanical and electromechanical systems, Transfer function and it realization using OP-AMP and block diagram representations of dc generator, dc and ac servomotors, servomechanisms. Block diagram reduction, signal flow graphs, Masons gain formula, limitations of mathematical models.

Time Response: Step response of first - and second - order systems, under

damped system response, over damped, critically damped system - time domain specifications, Concept of order of system, type of systems. Steady state errors, Error ratio, Static error Constants, Generalized error series. dynamic error coefficients, steady state errors due to Impulse, step, ramp and parabolic inputs. Frequency response of a system, frequency domain specifications. Different types of controller, Proportional control, proportional-plus- integral control, proportional-plus-derivative control. proportional-plus- integral-plus-derivative control, their realization. Tuning the controllers - ziegler and Nicholas methods.

UNIT-II

Stability- Concept and definition, BIBO stability, location of the roots of the characteristic equation in the S-plane, Routh-Hurwitz stability criterion,Bode Magnitude and phase plots, Concept of gain margin and phase margin. Root locus method, Magnitude and angle criteria, Root locus construction rules for positive K, interpretation of nature of system response from root locus plots. Polar plots, Nyquist criterion for stability, Nyquist diagrams.

Control system design, design specifications, series compensation, phase- lag and phase-lead compensation - frequency response approaches, lag-lead compensation.

Introduction to control machines – Synchro and Tachometers.

RECOMMENDED BOOKS:

1. K. Ogata - Modern Control Engineering.
2. Charles E. Rohrs. James L. Melsa and Donald G. Schultz-Linear Control systems- MGH, 1993.
3. B.C. Kuo- Automatic control system (ED. 7) -PHI, 1995.
4. David K. Cheng - Analysis of Linear System - Adison Wesley, London, 1994. Morris Driels - linear Control Systems Engineering- MGH, 1996.
5. Norman S. Nise- Control System Engineering-wiley publisher

V SEMESTER B.TECH. (E & E)

EE1503 **4 HRS./WEEK**

MICROPROCESSOR AND MICROCONTROLLER

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Introduction to Microprocessor architecture, Memory Mapping.
8085 CPU Architecture, Signal descriptions, 8085 system,8085 Instruction Set, addressing modes, Programming using 8085 Instruction set, Instruction cycle, Machine cycles, Timing diagrams.
Interfacing Devices- Tristate devices, Buffers. Latches, 74 LS 138, 74 LS 245, 74 LS 148, 74 LS 373.
Hardware Interfacing-interfacing memory, Interfacing I/O: Memory mapped and I/O
Mapped
8085 Interrupts system.
Interfacing ADC AD558 and Interfacing DAC using status check with 8085.

UNIT-II

Peripherals:
Programmable PPI 8255
Programmable Interval Timer- 8253.
Introduction to DMA with relevance to 8085 CPU& DMA Controller- 8257.
USART -8251.
Interfacing these peripheral to 8085 CPU and their applications.
Introduction to Micro controller architecture:
8051/8052/8031micro controllers Architecture,
Memory addressing,
Addressing modes, Instruction Set,
I/OPort programming, Timer/Counter Programming, Interrupt programming

RECOMMENDED BOOKS:

1 Ramesh S. Gaonkar - microprocessor Architecture, Programming and Applications with 8085/8080A (Third Edition) – Penram International
2 The 8051 Microcontroller & Embedded Systems-M. Ali Mazidi- LPE edition
3. Fundametal of Microprocessors- B. Ram Dhanpat Rai
4. Intel- C.H. Embedded Controller Handbook Vol-I 8 bit - Intel Corporation, 1988.
5. Wiatrowski C and House C.H.- Logic Circuits and Microcomputer Systems MGH, 1980.

V SEMESTER B.TECH. (E & E)

EE1504 **4 HRS/WEEK**

DIGITAL SYSTEM DESIGN

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Review *of* Sequential Machine Fundamental: Concept of memory, general model of sequential machine and classifications, clocked flip flop, SR, D, T arid JK flip- flops,

Excitation tables, Practical clocking aspects, timing and triggering considerations.

Analysis and Design of synchronous sequential finite state machines: ASM charts, synchronous analysis process, Design approaches, state reduction, design *of* next state-decoder and output decoder, design *of* counters and registers, code sequence detectors. sequential code generators,

Introduction to system controller design: System controller state specification (MDS diagram), timing and frequency considerations, synchronizing systems, state assignments, implementation using ROM, PAL, PLA.

Linked state machines.

Analysis and Design *of* Asynchronous sequential Finite state Machines: Need for Asynchronous circuits, Analysis, Cycles and Races, Hazards, Map entered variable approaches to asynchronous design.

UNIT-II

Introduction to VLSI: Benefits *of* integration, criteria for evaluating implementation styles, introduction to computer-aided- design.

Introduction to Modern Digital System Implementation options- Mask Programmable gate array, cell based integrated circuits.

Field programmable logic device: complex PLDs, field programmable gate *arrays.*

Interfacing Units: Sampling, as aliening, antialiasing filters, sample and hold circuits, DACs, resistive ladder networks, (Weighted R, R-2R Net works), characteristics *of* DACs.

Methods *of* A/D conversions: simultaneous conversion, counter method, continuous A/D dual slope A/D successive approximation technique, characteristics *of* ADCs. Data acquisition systems.

RECOMMENDED BOOKS:

1. William I. Fletcher- An Engineering approach to Digital Design- PHI. 1993.
2. D.H. *Green*- Modern Logic Design- Addison Wesley, 1993.
3. Malvino and Leach- Digital Principles and Applications- MGH. 1986.
4. B.S. Sonde. Data converters- TMH, 1979.
5. Morant M.J. -Integrated Circuit Design and Technology- Chapman and Hall 1990.
6. Wakerly- Digital Design: Principles and Practice- PH, 1994.

V SEMESTER B.TECH.(E&E)

EE1507 **PRINCIPLES OF COMMUNICATION** **4 HRS/WEEK**

No. of questions to be set: 8 (Four from each unit)

No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

1. Introduction to Communication Systems:
Elements of a general communication system, frequency translation and its need, internal and external noise.

2. Analog Modulation:
Amplitude Modulation, generation and detection of AM., DSB-SC and SSB-SC, VSB, FDM.

3. Angle Modulation:
Phase and frequency modulation, generation and detection of FM Signal NBFM and - WBFM, Pre-emphasis and De-emphasis circuits.

4. Pulse Modulations:
Sampling of analog signal, Sampling theorem, PAM, PPM, Channel band width, TDM Pulse code modulation. Delta and adaptive Delta Modulation. Companding Channel Capacity.

UNIT-II

5. Digital Modulation:
Binary communication, On-Off Keying, Frequcncy Shift Kcying(FSK), Phase shift keying(PSK), Detection of binary signals, Multi symbol signaling, Quadrature Amplitude Modulation(QAM),

6. Data Communication:
Analog and Digital Data, Transmission Media. Asynchronous and Synchronous Transmission, Error detection techniques, Interfacing, Local Networks: Local Network technology, Bus/Tree topology, Ring topology, Medium Access Control Protocols: Bus/ tree topology-token Bus, Ring topology- token ring, IEEE 802 Ring LAN standard, FDDI Ring.

7. The OSI Model
The Model Layered Architecture; Function of the layers – Physical Layer, Data Link Layer, Network Layer, Transport Layer, Session Layer, Presentation Layer, Application Layer, Summary of Layer Functions.
TCP/IP Protocol Suite

RECOMMENDED BOOKS:

1 Taub & Schilling: Principles of communication systems, Int. student Ed.
2 Mischa Schwartz: Information, Transmission, Modulation & Wire, Int. Student Ed.
3. William Stallings: Data and Computer Communication, Max Well, Mc Millan International Ed.
4. Siman Haykins: Comm. Systems, Wiley Eastern Edn.
5. B.P.Lathi: Modern Digital and Analog Communication Systems.
6. George Kennedy: Electronic Comm. Systems, TMH.

V SEMESTER B.TECH. (E & E)

EE1506 **4 HRS/WEEK**

POWER SYSTEM ANALYSIS

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Representation of power systems: One line diagram, impedance & reactance diagrams.

Per unit notation selection & change of base for per unit quantities.Thevenin's model for

power system, equivalent circuit in permit of three winding transformers, fixed tap changing transformers with off- nominal turns ratio. Network reduction using matrix algebra.

Formation of Y bus Z bus matrices, Z bus algorithm, measurement of elements of Y and Z matrices, significance.Symmetric three phase Short circuit calculations using Z bus.

UNIT-II

Symmetrical 3 phase faults: Short circuit currents and reactance of Synchronous machines. Short circuit current calculations of unloaded & loaded Generators and power systems.Selection of circuit breakers, current-limiting reactors.Sequence components of line and phase voltages and currents of star-delta transformer banks. Sequence impedance's and networks of power system elements. Analysis of unsymmetrical faults in generator and power system under no load.Load flow studies: Formulation of Load flow equations, types of buses. Load flow solution techniques (using bus only) Gauss-Seidel, Newton Raphson (in polar coordinates only), Acceleration factors.Decoupled, fast decoupled method.

RECOMMENDED BOOKS:

1.A Chakraborti&Halder – Power System Analysis, Operation & Control, PHI

2. Nagrath and Kothari- Modern Power System Analysis (ED.2) - TMH, 1989

3.. Stevenson - Elements of Power System Analysis (Ed 3) -MGH, 1975.

4.Elgerd OI - Power system analysis- TMH.

5. Shipley – Matrices & Power Systems – John Willy.

V SEMESTER B.TECH. (E & E)

EE1561 **3 HRS/WEEK**

MICROPROCESSORS AND MICROCONTROLLER LAB

1. WAP to Add two-8-bit numbers 04H and 08H and store the result in a particular address.
2. WAP to move an immediate data 07H, increment the value by 1 and store the data in a memory location.
3. WAP to move an immediate data 07H into memory.
4. WAP to add the decimal numbers 208 and 100 and store the result in particular address.
5. WAP to find 1s compliment of a given number.
6. WAP to find 2s compliment of a given number.
7. WAP to for subtraction without using SUB instruction.
8. WAP to subtract two 8 bit numbers for both positive and negative results.
9. WAP to subtract any two numbers giving only positive answer.
10. WAP to multiply two 8 bit numbers.
11. WAP to divide an 8-bit number by another 8-bit number. The result i.e. the remainder and quotient should be stored in two different consecutive memory locations.
12. WAP to arrange three 8-bit numbers in ascending and descending order in consecutive memory location.
13. WAP to find out the greatest and smallest value among four 8-bit data.
14. WAP to add four 8-bit numbers.

Extra Experiments (beyond course curriculum)

15. WAP on microcontroller to light two LEDs alternately (toggling program).
16. WAP on microcontroller to interface with LCD.
17. WAP on microcontroller to control an H Bridge.

V SEMESTER B.TECH. (E & E)

EE1562 **3 HRS./WEEK**

ELECTRICAL MACHINES LABORATORY-II

1. No Load, Blocked Rotor test on three phase squirrel cage Induction Motor
2. Load Test on three phase squirrel cage Induction Motor
3. Torque Slip Characteristics of Slip ring Induction Motor by varying rotor resistance
4. Load Test on Induction Generator
5. Predetermination of Voltage Regulation of Alternator by EMF and MMF methods
6. Measurement of Direct Axis and Quadrature axis reactance of salient pole
7. V curve and Inverted V curve of Synchronous Motor

V SEMESTER B.TECH.(E&E)

EE1563 **3 HRS/WEEK**

CONTROL LAB – I

1. To study the torque-speed characteristics, step response and to find the transfer function of the d.c. motors.

2. To study the performance characteristics of a d.c. motor angular position control system.

3.To study the time response of variety of simulated Linear systems and to correlate the studies with theoretical values.

4. To study the characteristics of a linear variable differential transformer.

5. To study the performance characteristics of an angular position error detector using two potentiometers.

6.To study the performance of various type of controllers used to control the temperature of an oven.

7. To study the performance characteristics of a d.c. motor speed control system.

8. To study digital control of a simulated system using an 8-bit microprocessor.

9.To study the characteristics of a synchro transmitter receiver pair and use these as torque-synchro and angular error detector.

10. To study the effects of different cascade compensation networks.

Extra Experiments (beyond course curriculum)

11. To study the configuration and evaluate the performance characteristics of a feedback light intensity control system.

12. To study the performance characteristics of an analogue PID controller using simulated systems.

13. To study simple input-output operations of a microprocessor through programmable peripheral interface, 8255.

14. To study the features and characteristics of a number of digital to analog converter circuits including an IC type AD7533.

15. To study the characteristics of a small ac servomotor and determine its transfer function.

CONTROL LAB - II

List of experiments (New list of experiments, experimental manuals are to be made)

1. (a) To study the different components of SCADA.

   (b) Application of SCADA for water level control.

2. To study the pressure control loop trainer for operation in manual and auto mode **(Exp. done manual is ready).**

3. To study the Level control trainer for operation in manual and auto mode.

4. To study the Flow control loop trainer for operation in manual and auto mode.

5. To study the AC position control through step and continuous command

6. To study the piezo electric transducer.

7. To study pressure transducer.

Extra Experiments (beyond course curriculum)

8. To study the dynamic characteristics of a system with an intentional non linearity viz. a simulated relay.

9. To study the speed control of permanent magnet DC motor by Dc voltage control and pulse width modulation technique.

VI SEMESTER B.TECH. (E & E)

EE1601 **4 HRS/WEEK**

POWER SYSTEM STABILITY, OPERATION AND CONTROL

No. of questions to be set: 8 (Four from each unit)

No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Introduction: Operating states, Preventive and emergency control, Megawatt-frequency and megavar-voltage interaction. **Load Frequency Control:** Introduction, Speed governing system and modeling, Turbine modeling, Generator-load modeling, Steady-state and dynamic response of ALFC loop, The secondary ALFC loop, Integral control. **Multi Control Area System:** Introduction, Pool operation, Two area systems, Modeling of tie line, Static and dynamic response of two area system, Tie-line bias control, Tie-line control, Digital electrohydraulic (DEH) control system, Implementation of DEH system.

Reactive Power Control: Introduction, Methods of voltage control, Power capacitors and its application to distribution and transmission system, Static var system.

UNIT-II

Excitation System: Introduction, Elements of an excitation system, Types of excitation system, Digital excitation system.

Power System Security: Introduction, Factors affecting power system security, Introduction to contingency analysis. **Power System Restructuring:** introduction, Regulation vs. Deregulation, Competitive Market for Generation, The Advantages of Competitive Generation, Electric Supply Industry Structure Under Deregulation in India. Restructuring Models.

Power System Stability: Introduction to Power system Stability **c**lassification, Small signal and Transient stability, Rotor angle & Voltage Stability. Stability problem, swing equation and its numerical solution, Determination of initial state in a multi-machine system, Base case Y BUS and modified Y BUS, Computational algorithm, Improvement of stability.

RECOMMENDED BOOKS:

1. Electric Energy Systems Theory an Introduction - Olle I. Elgerd
2. Power Generation Operation and Control - A.J. Wood, B.F. Wollenberg
3. Power System Deregulation by Loi Lei Lai
4. Power System Stability and Control - P. Kundur
5. Electric Power Distribution System Engineering - T. Goneen
6. Power System Analysis – Grainger & Stevenson
7. Power System Analysis, Operation & Control- Chakraborti & Haldar

VI SEMESTER B.TECH. (E & E)

EE1602 **4 HRS/WEEK**

ADVANCED CONTROL THEORY

No. of questions to be set: 8 (Four from each unit)

No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Sampled Data Control Systems, Sampling process, ideal sampler, Sample hold circuit, Shannon's sampling theorem, zero order hold. The Z transform, mapping between s and z domains, definition and evaluation of z- transforms, the inverse z-transform, theorems and properties of z-transforms, the pulse transfer function, pulse transfer function of ZOH, System stability, z-plane stability, Jury's test, Bilinear transformation.

State space analysis, Concept of State, State Vector, State models, State models of electrical, Realization of state models from transfer functions, controllable canonical from and observable canonical form, cascade realization, parallel realization Hamilton theorem, properties for state transition matrix discrete time state equation, state diagrams, realization of pulse transfer functions.

UNIT-II

Nonlinear Systems, Introduction, Commom Physical Non linearities, Limit Cycle, The Phase Plane Method: Basic Concept, Singular Points, Stability of Nonlinear Systems, The Describing function Method: Basic Concept , Derivation of Describing Functions, Stability Analysis by Describing.

RECOMMENDED BOOKS:

1. K.Ogata-Modem Control Engineering (ED.2)-PHI, 1995.
2. KOgata-State Space Analysis of Control Systems-PHI, 1967.
3. M.Gopal-Digital Control engineering- Wiley Eastern, 1988.
4. Charles LPhillips and Royee D. Harbor- Feed Back Control systems (ED.2)-

   PHI, 1991

INDUSTRIAL MANAGEMENT

(BA-1510)

B. Tech. (CE; EC, IT & EE)

Industrial Management

VI/VII Semester

Contact Hours : 4 hrs./week

No. of questions to be set : 10 (2 from each unit)

No. of questions to be answered: 5 (1 from each unit

UNIT I

Philosophy and Development of Management thought. Concept and definition of management, Functions and Roles of Management, Social Responsibilities of Management.

Pioneers in Management, Taylor's Scientific Management, Contribution of Henry Fayol, Gilberth and Mayo.

Schools of Management Thought: Human Behaviour, Social System, Systems approach, management process school.

Process of Management: Functions of Management.

i. **Planning:** Nature and purpose of planning objectives, Different types of Plans, steps in planning, schedule planning, product planning, Strategic Planning, Long, medium and short term planning, decision making, project planning, management by objectives.
ii. **Organizing** Principles of organizing, steps in organizing, organizational structure, levels and span of management, departmentation, span of control, formal and informal organization, de-centralization, committees, line and staff functions, responsibility and accountability, delegation of authority.
iii. **Staffing:** Manpower planning and recruitment, selection process, training and development, performance appraisals.
iv. **Leading:** Models and styles of leadership, managerial grid, motivation, interpersonal relations, personality, communication process, types, barriers, effective communication.
v. **Controlling:** Concept, nature and purpose, process, methods and practice of control, role of internal audit.

UNIT II

Quantitative Techniques in Managerial Decisions: Concept of budget and budgetary control. Time-event network analysis; ABC Analysis, Break-even Analysis; Decision Tables; Concept of productivity, measuring productivity, Use information technology

Production Management

Types of production; Types of Planning, Manufacturing Planning; Production planning, Scheduling; Work study & Method Study; Systems of wage payments, bonus, Automation. Organization of production, planning and control department.

Materials Management

Practice of purchasing and materials management, quality, quality standards and inspection, , sources of supply; pricing principles and practices. Inventory Mangement, EOQ model; Value Analysis and Value Engineering.

References:

a) H. Koontz and H. Weihrich, “Management”, McGraw Hill, 1989.

b) Dobler W.D. “Purchasing & Materials Management”, TMHC, New Delhi, 1984.

VI SEMESTER B.TECH(E&E)
ELECTIVE-I

EE1631 **4HRS/WEEK**

PROGRAMMING WITH JAVA

No. of questions to be set: 8 (Four from each Unit)
No. of questions to be answered: 5 (Minimum of two questions from each Unit)

UNIT-I

Introduction To Java: Overview of Java, Introduction to Object Orientated Programming Language, Features of Java, Comparison of Java with Other Languages- Java Vs C, Java Vs C++, Java Virtual Machine (JVM). Types of Java Program- Standalone Programs, Applets, Servlets, Java Architecture, Steps Involved in Running Java Programs Using JDK (Standalone, Applets)
Data Types and Operators: Tokens, Identities, Constants, Data Types, Operators, Operator Precedence, Type Casting
Looping and Selection Statements: Control and Looping Statements - Input / Output, Control Flow, Decision Making- Switch, If-Else, Loop- While, For, Do While, Break, Continue, Return.

Introducing Classes: Class fundamentals, declaring objects, assigning object reference variables, introducing methods, constructors, this keyword, garbage collection, the finalize method. The First Java Program, Compiling and Executing Java Program. Overloading methods and constructors, Using object as parameter, argument passing, returning objects, Access control, static methods, nested and inner classes, Command Line Arguments.
Arrays: One dimensional array, array of objects, multidimensional arrays, vectors.
String Handling: String constructors, string length, special string operators, character extraction, different string manipulation functions.

UNIT-II

Inheritance, Interfaces and Packages: Introduction, Inheritance in Java, Extending a Class, Methods Overriding, Introduction to Interface, Creating an Interface. Defining and creating packages, access protection, importing packages.

Applets and Graphics: The Applet class, Simple program on Applets, The HTML applet tag, passing parameter to applet. Event handling, Abstract Window Toolkit (AWT), AWT classes, AWT controls.

Multithreaded Programming: What is Thread? Creating Java Threads, Extending the Threads Class, Stopping and Blocking a Thread, Life cycle of a Thread, Using Thread methods, Thread Exceptions, Thread priority, Implementing the 'Runnable' Interface.

Exception Handling: Exception classes, catching an exception, catching multiple exception, throwing an exception, creating own exception class.
Input/Output and Stream Class: Java I/O Classes and Interfaces, The string classes, Byte streams, the character streams.

RECOMMENDED BOOKS:

1. E.Balagurusamy, Programming with JAVA- A Primer, 3/e, Tata McGraw Hill, 2007. ISBN-10:0-07-061713-9.
2. Herbert Schildt, "Java: The Complete Reference", Tata McGraw Hill.
3. K. Arnold and J. Gosling, "The Java Programming Language", Addison Wesley.

VI Semester B.Tech.(E&E)

ELECTIVE-I

SOFTWARE ENGINEERING

EE1632 **4HRS/WEEK**

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Introduction: Emergence of software engineering, Notable change in software development practice.

Software Life Cycle: Classical Waterfall Model, Iterative Waterfall Model, Prototype Model, Evolutionary Model, Spiral Model, Comparison of different Life Cycle Models

Software Project Management: Responsibilities of Software project manager, project planning, Metrics for project size estimation, Project estimation techniques, Empirical estimation techniques, COCOMO-a Heuristic estimation techniques, scheduling, organization and team structure, risk management.

Requirement analysis and specification: Requirement gathering and analysis, software requirement specification (SRS), Formal system development techniques, Axiomatic specification, Algebraic specification.

Software design: What is a good software design, Cohession and coupling, next arrangement, software design approachs Object oriented vs. functional oriented design

UNIT-II

Object oriented software development: Design pattern, A generalized object oriented analysis and design, examples, OOD goodness criteria.

Coding and testing: Coding, Code review, Testing, Testing in the large vs testing in the small, unit testing, Black box testing, Debugging, program analysis tool Integration testing, system testing, Some general issues associated with testing.

Software reliability and quality management: Software reliability, Statistical testing, software quality management system, ISO 9000, SEI capability maturity model, Personal software process(PSP), Six sigma

Computer aided software design: CASE and its scope, CASE environment, CASE support in software life cycle, Other characteristics of CASE tools, Architecture of CASE environment

Software Maintainance: Characteristics of software maintenance, Software reverse engineering, software maintenance process model, Estimation maintenance cost.

RECOMMENDED BOOKS:

1. Fundamentals of software engineering by Rajib Mall PHI Publications
2. An Engineering approach to software engineering by Jalot Pankaj, Narosa Publication
3. Object oriented software engineering by Jacobson I , Addison Wesley Publication.

VI SEMESTER B.TECH. (E & E)

ELECTIVE I

EE1633 **4HRS/WEEK**

DATABASE MANAGEMENT SYSTEM

No. of questions to be set: 8 (Four from each unit)

No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Introduction to data base systems- concepts, overview, terminologies data models.

Physical data organization- Sequential, indexed, hash files.

B trees, dense and sparse index files, variable length records. Look up on non key attributes, partial match retrieval, range queries.

Network models- DBTG DDL, implementation operations such as insertion, deletion & modification, hierarchical model implementation.

Hierarchical model architecture: Data definition and manipulation in hierarchical database.

UNIT-II

Relational model storage organization, relational algebra, relational calculus, relational query language. Overview of SEQUEL, QUEL, QEE.

Design theory of relational database functional dependencies, decomposition of relational schema, normalization.

Database protection integrity & security, concurrent operations on database.

Introduction to distributed database systems.

RECOMMENDED BOOKS:

1. C.J. Data "An Introduction to Database Systems" Vol. I & Vol. II
2. James Martin "Principles of Database Management Systems" Prentice Hall of India, New Delhi.
3. Elamsri Navathe "Fundamentals of Database Systems"
4. Abraham Silberschatz, Henry F. Korth, S. Sudarshan "Database Management System Concepts "
5. Jeffrey O Ullman "Principles of Database Systems"

VI SEMESTER B.TECH. (E & E)
DATA STRUCTURES & ALGORITHMS

EE1635 **4HRS/WEEK**

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Time and Space Complexity. Time and Space analysis of Algorithms - Order Notations.

Linear Data Structures - Sequential representations - Arrays and Lists, Stacks, Queues and Dequeues, strings, Application.

Linear Data Structures, Link Representation - Linear linked lists, circularly linked lists. Doubly linked lists, application.

Recursion - Design of recursive algorithms, Tail Recursion, When not to use recursion, Removal of recursion.

UNIT-II

Non-linear Data Structure: Trees - Binary Trees, Traversals and Threads, Binary Search Trees, Insertion and Deletion algorithms, Height balanced and weight-balanced trees, B-trees, B+ - trees, Application of trees; Graphs - Representations, Breadth-first and Depth-first Search.

Hashing - Hashing Functions, collision Resolution Techniques.

Sorting and Searching Algorithms- Bubble sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and Radix Sort.

File Structures - Sequential and Direct Access. Relative Files,Indexed Files - B+ tree as index. Multi-indexed Files, Inverted Files, Hashed Files.

RECOMMENDED BOOKS:

1. Data Structures and Algorithms – O.G. Kakde & U.A. Deshpandey, ISTE/EXCEL BOOKS

2. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., "Data Structures and Algorithms", Addison Wesley

3.Heileman:data structure algorithims &Oop Tata McGraw Hill

4. Data Structures Using C – M.Radhakrishnan and V.Srinivasan, ISTE/EXCEL BOOKS

5. Weiss Mark Allen, "Algorithms, Data Structures, and Problem Solving with C++", Addison Wesley.

VI SEMESTER B.TECH. (E & E)

ELECTIVE-I

FUNDAMENTALS OF NANO-ELECTRONICS

EE1637 **4HRS/WEEK**

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Introduction to Nanotechnology and Nanoscience- a brief overview.

Nanostructured Materials: Introduction to (i) Carbon Nano tubes (CNTs) - Single-walled Carbon Nano tubes (SWCNTs), Multi-walled Carbon Nanotubes (MWCNTs), BN Nano tubes, (ii) Carbon Nano fibres (CNFs), (iii) Nanowires, (iv) Nanocomposites, (v) Nanocones (vi) Nanorods.

Characterization Techniques of Nanomaterials:

1) Scanning Probe Microscopy: Atomic Force Microscopy (AFM), Scanning Tunnelling Microscopy (STM) - Characterization and sample preparation techniques.
2) Electron Microscopy- Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) - Characterization and sample preparation techniques.
3) Thermo-physical characterization: Differential Scanning Calorimetry (DSC) and Thermo Gravimetric Analysis (TGA).
4) Electrical Characterization: Electrical conductivity and Dielectric properties of materials., nano filled resin for cast insulator, capacitors etc

UNIT-II

Nanoelectronics- Introduction, fundamental concepts, technological evolution.

Basic Nanoelectronic Technologies- Single Electron Devices, Quantum Mechanical Tunnel Devices, Spin Nanoelectronics (Spintronics), Molecular Nanoelectronics, Quantum Computing.

Nanoelectronic Systems- Quantum Dots and Quantum Wires (determination of resistance, charge concentration, charge mobility), Fabrication Methods and Techniques for

Nanoelectronics, Microscopy Tools for Nanoelectronics, Microelectromechanical Systems (MEMS) and Microoptoelectromechanical Systems (MOEMS) Applications.

RECOMMENDED BOOKS:

S. Saito, A. Zettl- Carbon Nanotubes: Quantum Cylinders of Graphene

Daniel Minoli- Nanotechnology Applications to Telecommunications and Networking

Badih El-Kareh- Silicon Devices and Process Integration: Deep Submicron and Nano-Scale Technologies

Research papers/conference proceedings.

VI SEMESTER B.TECH. (E & E)

ELECTIVE-I

EHV AC & DC TRANSMISSION

EE1638 **4HRS/WEEK**

No. of questions to be set: 8 (Four from each unit)

No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Aspects of EHV AC and DC transmission. General Background and State of art of EHV AC Transmission Technology Bundled conductors, Maxwell's Coefficients, Inductance and capacitance matrices

Surface Voltage gradient on bundled conductors, Mangoldt's formula, Gradient factors. Corona Effects : Power Loss, Audible noise, BI & TVI. Ground level electrostatic field of EHV Lines. Switching over-voltages in EHV Systems. Introduction to FACTS.

Introduction to HVDC transmission: Comparison with EHV AC power transmission, HVDC system configuration and components. Principles of AC/DC conversion: Converter connections, Wave forms, Relevant Equations, Reactive Power requirements.

UNIT-II

Harmonics and Filters : Waveforms of a-c bus currents in Star/Star, Star/delta & 12-phase converters and their Fourier-series representations, Non-characteristic harmonics, Harmful Effects of Harmonics, DC side harmonics, Filters and detuning, Cost considerations of filters.

HVDC system control : CC and CEA controls, Static characteristics of converters, Combined characteristics of rectifier and inverter, Power reversal, Asynchronous & synchronous HVDC links, Frequency Control of A.C. system, Stabilisation & damping of A.C. networks, CP Control

HVDC systems elements: Converter transformers, D.C. smoothing reactors, Thyristor valves etc., Earth electrodes & earth return

RECOMMENDED BOOKS:

1. R.D. Begamudre, Extra High Voltage AC Transmission Engineering, Wiley Eastern Ltd., 1986.
2. S.Rao, EHV AC and HVDC Transmission Engineering & Practice, Khanna Publishers, Delhi, 1990.
3. HVDC Power Transmission Systems by K. Padiyar, Wiley Eastern Ltd.
4. EHV AC and HVDC Transmission Engineering and Practices by S.S. Rao, Khanna Publications.
5. Reactive Power Control & Voltage Stability in EHV-AC Transmission System- A. Chakraborti, PHI

VI SEMESTER B.TECH. (E & E)

ELECTIVE-I

EE1639 PROCESS CONTROL & INSTRUMENTATION 4HRS/WEEK

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

Objectives: This course delves into the processes of Process Control to provide the basic foundation in Process control. All detailed basics required are covered.

Pre-requisites: Basic process control loop, Schemes of control of Flow, State controllability, Self-regulation

UNIT – I

The basic process control loop - different blocks in it, how is it different from 'servo' Loop.
Process modelling, process equations – their limitations - general approach. Typical processes and derivation of their transfer functions. Effect of disturbances and variation in set point in process control. Offset - why does it appear, analysis, how is it eliminated.
Process Reaction Curves, Controllability – using: deviation reduction factors, Gain Bandwidth product, State controllability, Self-regulation.
Schemes and analysis of: (i) On-off control, Time proportional control, PI and PID Control – Ziegler – Nichols method, Cohen - Coon method and 3-C
Method of parameter adjustment
Controllers - development, diagrams and brief analysis: Pneumatic, Hydraulic, Electronic, Test of Controllers
Multiloop control strategies: schemes, brief analysis and uses: Ratio control, Cascade control, Feed forward control, Multivariable control

UNIT – II

Electric Drives: Energy Saving with adjustable Speed Drives, AC and DC Adjustable Speed Drives, Stepper motor Drives, Servo Drives
Final Control Element: Types of Actuators and Control valves, Safety and solenoid valves, Pneumatic Actuators, Electrical Actuators, Valve characteristics, C_v values, Valve sizing, Valve selection, cavitation, linearization, positioners,
P-I and I-P converters (Drive circuits for Electrical Actuators).Elements of a digital control loop. Development of a control algorithm, direct digital control, Hierarchical control.
Control of a specific plant like: (i) Distillation column. (ii) Combustion control in a boiler.
(iii) Drum Level Control.

RECOMMENDED BOOKS:

1. D. Patranabis, Principles of Process Control, TMH, New Delhi, 2nd Ed.
2. D. P. Eckman, Automatic Process control, John Wiley, New York
3. B. G. Liptak, Instrument Engineers Handbook, Chilton Book Co., Philadelphia
4. P. Harriott, Process control, Mc Graw Hill, New York.

VI SEMESTER B.TECH.(E&E)

EE1603 **4 HRS/WEEK**

ADVANCED MICROPROCESSOR & EMBEDDED SYSTEMS

No. of questions to be set: 8 (Four from each unit)

No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

UNIT-I

Internal architecture of 8086 CPU, Registers & Memory organization, 8086 basic system concepts, signals, instruction queue, MIN mode and MAX mode, Instruction sets, Addressing modes, assembly directives, assembly language program development tools & simple assembly programming, DOS function calls.

8086 Interrupt: types of interrupts, Interrupt vector table.
Macro, Basics of interfacing, Overview of DRAM and SRAM.
Introduction to higher bit processors, 80286, 80386, 80486, Pentium
Raspberry Pi

UNIT-II

Basic Embedded system, overview of main components and software tools in designing of an embedded system.
Introduction, Instructions and preliminaries of ARM processor, ARM Interrupt processing, Digital Signal Processors.
Memory Organization, Virtual Memory and Memory Management Unit, Power Aware architecture.
Introduction of different type of CPU buses
Fundamentals of Embedded Operating Systems, Scheduling Policies, Resource Management, Networked Embedded System.
VHDL: Introduction**,** Programming with different type of dataflow modeling.

RECOMMENDED BOOKS:

1. Advanced Microprocessor and peripherals, architecture, programming and interfacing, Ajoy Kumar Ray & Kishor M. Bhurchandi, Tata McGraw Hill Publishing Company limited.
2. Douglas V. Hall, "Microprocessors and Interfacing - Programming and Hardware", Tata McGraw-Hill Publishing Company Ltd., New Delhi, India
3. Raj kamal- Embedded Systems – Tata McGraw-Hill, 2004
4. F. Vahid, T. Givargis- Embedded System Design-John Wiley &Sons,Inc. 2002
5. VHDL Programming by example, Douglas L. Perry- McGraw-Hill

VI SEMESTER B.TECH.(E&E)

EE1604 RENEWABLE ENERGY SYSTEMS 4 HRS/WEEK

No. of questions to be set: 8 (Four from each unit)

No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT - I

Energy Scenario: Classification of Energy Sources, Energy resources (Conventional and nonconventional), Energy needs of India, and energy consumption patterns. Worldwide Potentials of these sources. Energy efficiency and energy security. Energy and its environmental impacts. Global environmental concern, Kyoto Protocol, Concept of Clean Development Mechanism (CDM) and Prototype Carbon Funds (PCF). Factors favoring and against renewable energy sources, IRP

Solar Energy: Solar thermal Systems and power generation: Types of collectors, Collection systems, efficiency calculations, applications. Photo voltaic (PV) technology: Present status, - solar cells , cell technologies, PV power generation, characteristics of PV systems, equivalent circuit, array design , building integrated PV system, its components , sizing and economics. Peak power operation, Solar tracking system, Standalone and grid interactive systems.

Wind Energy: Wind speed and power relation, power extracted from wind, wind distribution and wind speed predictions. Wind power systems: system components, Types of Turbine, Turbine rating Choice of generators, turbine rating, electrical load matching, Variable speed operation, maximum power operation, control systems, system design features, stand alone and grid connected operation, On shore and off shore wind energy.

UNIT - II

Hydro energy: Feasibility of small, mini and micro hydel plants scheme layout economics. Tidal and wave energy, Geothermal and Ocean-thermal energy conversion (OTEC) systems – schemes, feasibility and viability.

Energy storage and hybrid system configurations: Energy storage: Battery – types, equivalent circuit, performance characteristics, battery design, charging and charge regulators, battery management, flow batteries. Fly wheel- energy relations, components, benefits over battery. Fuel Cell energy storage systems. Ultra-Capacitors.

Grid Integration: Grid integration with the system: Interface requirements, Stable operation, Transient-safety, Operating limits of voltage, frequency, stability margin, energy storage, and load scheduling.

Hybrid Systems: Need for Hybrid Systems, Range and type of Hybrid systems, Case studies of Diesel-PV, Wind-PV, Microhydel-PV, Biomass-Diesel systems, electric and hybrid electric vehicles.

RECOMMENDED BOOKS:

1. Renewable energy technologies - R. Ramesh, Narosa Publication.
2. Energy Technology – S. Rao, Parulkar
3. Non-conventional Energy Systems – Mittal, Wheelers Publication.
4. Wind and solar systems by Mukund Patel, CRC Press.
5. Solar Photovoltaics for terrestrials, Tapan Bhattacharya.
6. Wind Energy Technology – Njenkins, John Wiley & Sons
7. Solar & Wind energy Technologies – McNeils, Frenkel, Desai, Wiley Eastern.
8. Solar Energy – S.P. Sukhatme, Tata McGraw Hill.
9. Solar Energy – S. Bandopadhay, Universal Publishing.

VI SEMESTER B.TECH.(E&E)

EE1661 **3 HRS/WEEK**

ADVANCED PROGRAMMING LAB

FIRST CYCLE: PROGRAMMING WITH C++LAB

CONTENTS

MODULE – 1	**SIMPLE C++PROGRAMS**
MODULE – 2	**FUNCTIONS AND ARRAYS**
MODULE – 3	**USE OF CLASS AND FUNCTIONS**
MODULE – 4	**OPERATOR VOERLOADING**
MODULE – 5	**INHERITANCE AND POLYMORPHISM**

SECOND CYCLE: PROGRAMMING WITH MATLAB

CONTENTS

MODULE – 1	Introduction to MATLAB
MODULE – 2	Graphics using MATLAB
MODULE – 3	Mathematical models and time domain analysis of LTI systems.
MODULE – 4	Familiarization of Transfer function and State space models Block diagram reduction.
MODULE – 5	To obtain the step/impulse/ramp response of the given system.

Extra Experiment (beyond course curriculum)

Simulation using simulink

VI SEMESTER B.TECH.(E&E)

EE1662 **3 HRS/WEEK**

POWER ELECTRONICS LABORATORY

1. To conduct self – commutation of an SCR:
   (i) Observe the output voltage waveform with (a) fixed load, varying switching frequency and (b) fixed frequency, varying load.
   (ii) Determine switching frequency at which commutation fails.
   (iii) Device turn-off time (td)

2. To conduct resonant commutation of a SCR:
   (i) Observe the output voltage waveform across the load resistance (a) at constant frequency, variable load and (b) constant load, variable frequency.
   (ii) Switching frequency at which commutation fails.
   (iii) Device turn-off time (td).

3. To conduct auxilliary commutation of a SCR:
   (i) Observe the output voltage waveform across the load resistance (a) at constant frequency, variable load and (b) constant load, variable frequency.
   (ii) Switching frequency at which commutation fails.
   (iii) Device turn-off time (td).

4. In a single-phase current source inverter
   (i) Observe the output voltage waveform across the resistive load at different frequencies with fixed load.
   (ii) Observe the output voltage waveform with different load values at a fixed frequency.
   (iii) Determine the harmonics present in the output voltage waveform so obtained.

5. In a thyristorised Buck Chopper circuit
   (i) Observe output voltage waveform at (a) fixed duty ratio, variable frequency and (b) fixed frequency, variable duty ratio.
   (ii) Determine device turn-off time (td)
   (iii) Determine average output voltage.

6. Conduct speed control of a single-phase induction motor at no load with single-phase ac voltage regulator using TRIAC.

7. In a single-phase, half and fully-controlled full-wave rectifier
   (i) Observe the output voltage waveform across R and R-L load with freewheeling and without freewheeling diode.
   (ii)Determine output average voltage and ripple factor.

8. In a three-phase fully controlled rectifier
   (i) Observe the triggering pulses with varying firing angle along with supply voltage waveform.
   (ii) Observe the output voltage waveform across R and R-L load with varying firing angle.

(iii) Determine output average voltage.

9. In a three-phase cycloconverter.
(i) Observe the output voltage waveform at a reduced frequency in constant V/F mode of operation.
(ii) Observe the output voltage waveform at a reduced frequency in normal mode of operation.

10. In a SCR series inverter
(i) Observe the output voltage waveform at various frequencies.
(ii) Measure the SCR turn off time by observing the thyristors voltage drop waveform.
(iii) Tabulate the output frequency and the SCR turn off time.

11. In a three-phase half controlled rectifier
(i) Observe the triggering pulses with varying firing angle along with supply voltage waveform.
(ii) Observe the output voltage waveform across R-L load with varying firing angle.
(iii) Determine output average voltage.

Extra Experiments (beyond course curriculum)

12. Perform simulation for a single-phase a.c. voltage controller using phase angle control technique using CASPOC.

13. Perform simulation for a single-phase fully controlled and half controlled rectifier using CASPOC. Observe the effect of varying load filter element, load variation, load type variation on the output voltage and output current waveform.

14. Perform simulation for a three-phase fully controlled and half controlled rectifier using CASPOC. Observe the effect of varying load filter element, load variation, load type variation on the output voltage and output current waveform.

15. Perform simulation for a PWM based single-phase voltage source inverter using CASPOC.

VI SEMESTER B.TECH.(E&E)

EE1663 **3 HRS/WEEK**

POWER SYSTEM LAB

1. Determination of ABCD parameter of scale down model of a 620 MVA, 275 kV, 400 km transmission line using AC network analyzer.
2. Study of differential protection of 3-Phase alternator.
3. Study of differential protection of 3-Phase transformer.
4. Time-Current characteristics of an over current relay.
5. Tie-Line modeling of multi area AGC system in Simulink environment.
6. Load flow analysis using ETAP.
7. Fault analysis using PSCAD.
8. Determination of I-V Characteristics of solar panel.
9. Demand response analysis using Energy plus and BCVTB.
10. Grid integration of solar energy.
11. MPPT for Photovoltaic Power System.
12. Microcontroller based static VAR compensator.

VII SEMESTER B. Tech. (E&E Engg.)

EE1705 **4 Hrs./WEEK**

ELECTRICAL DRIVES

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

ELECTRIC DRIVES RATINGS:

Advantages of Electric drives, Factors affecting the choice of electric drives, Methods of closed loop control of drives, Selection of motor power rating, Thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating, equivalent current, torque and power methods, short time duty, intermittent duty.

DC MOTOR DRIVES:

Performance characteristics of dc series, shunt and compound motors, Braking - Regenerative, dynamic and plugging.
Transient analysis of separately excited motor with armature voltage control, Starting, dynamic braking and energy loss.

UNIT-II

SPEED CONTROL OF D.C. DRIVES: Armature voltage control, Flux control, Armature resistance control, Methods of speed control of single phase and three phase converter fed separately excited dc motor(Block diagram approach only), Speed control of chopper fed dc motor (Block diagram approach only), Four quadrant dc drive. Performance and control of static converters.

AC MOTOR DRIVES:

Induction motor drive: Performance characteristics of squirrel cage and slip ring induction motors, Braking - Regenerative, Dynamic and Plugging.
Transient analysis - Starting and Plugging, Calculation of energy loss. Speed control - Stator voltage control, Slip power recovery, E/f, V/f and flux weakening methods.

Synchronous motor drive: Starting and speed control of synchronous motor, reluctance motor, permanent magnet motor.

RECOMMENDED BOOKS:

1. G. K. Dubey - Fundamentals of Electric Drives NAROSA, 1995.
2. S. K. Pillai - First Course on Electric Drives – Wiley Eastern, 1990.
3. J.M.D. Murphy & F. G. Turnbull - Power Electronic Control AC Motors- Pergamon Press, 1988.
4. S. B. Dewan, G. R. Slemon, A. Straughen - Power Semiconductor Drives - John Wiley, 1984.
5. T.J.E. Miller - Brushless Permanent Magnet and Reluctance Motor Drives - Oxford Press, 1989.

VII SEMESTER B.TECH.(E&E)

EE1702 **4 HRS/WEEK**

SWITCHGEAR AND PROTECTION

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT–I

Functions of protective relaying, Fundamental characteristics of relays, Standard definition of relay terminologies, Relay classifications, operating principles of single and double actuating quantity type electromechanical relays. Directional relay, reverse power relay. Differential protection schemes for Bus bars, Transformer and Alternator. and transformers. Buchholtz relay for Transformer protection.

Alternator protection: Negative phase sequence relay, Loss of field protection, Reverse power protection.

Line protection: Various types of Distance relays, performance of distance relays, Distance protection schemes, Carrier current relaying.

Induction Motor Protection: Abnormal operating conditions, Contactors and circuit breakers for motors, Under voltage protection, phase and Earth fault protection, Overload protection, Single phasing preventer.

Solid state relays: Phase and amplitude comparators, Duality between phase and amplitude comparators, general equation for comparators, realization of directional, ohm, reactance, impedance and mho characteristics using general characteristic equation. Qualitative concepts of switched and non-switched scheme of static distance relays.

Computer aided relaying: Introduction to microcomputer based relays, Digital Protection general functional diagram of micro computer based relays. Advantages over conventional relaying techniques.

Types of System Transients: Surge phenomena, type and magnitude of switching and lightning over voltages.

Methods of over voltage protection –rod gap,valve,ZnO type-construction, working merits and applications, voltage and current ratings, residual voltage, selection of lightning arrestors. Insulation Coordination, BIL. Volt time characteristic Protection of transmission lines against over voltages.

UNIT-II

Fuses and switches: Rewirable fuses HRC features , construction, fuse elements , phenomena of cut off , selection of fuses , comparison of fuses and circuit breakers, grading ,overt current and short circuit protection.

Neutral grounding- capacitor coupling, disadvantages of ungrounded systems,effectively grounded, resistive and reactive grounding. Neutral grounding practices-

Circuit breakers- principle of working, arc phenomenon, methods of arc extinction, recovery and restriking voltage.

Circuit breaker ratings- breaking capacity , making capacity, various times associated with circuit breakers,

Construction, principle of working, merits and application oil circuit backers/air circuit breakers/ MCCBs/MCBs.

Physical chemical and dielectric properties of SF6, principle, construction of different types including puffer type, working, merits and application of SF6 breakers. SF6 field switchgear and gas insulated substations.

Physical and dielectric properties of vacuum, arc extinction in vacuum, construction, shape of electrodes, sealing merits and application of vacuum circuit breakers.

DC circuit breaker, principle and construction, working and application.Selection of CBS, Applications, Setting.

RECOMMENDED BOOKS:

1. S. S. Rao - Switchgear and Protection - Khanna Publishers, N.Delhi, 1990.

2 I. J. Nagrath and D. P. Kothari _ Power System Engineering, TMH, 1994

3. Chakraborti, Soni Gupta – A Textbook on Power System Engineering – Dhanpat Rai & Co.

4. Mason - The Art and Science of Protective relaying – Wiley Eastern publications, N.Delhi, 1992.

5. Badriram and D._.Vishwakarma - Power System Protection and Switchgear - TMH, 1995

6. Warrington A.R. and Van C - Protective Relays - Their Theory and Practice Vol.I & II - Chappman and Hall, London, 1969.

7. Ravindranath B. and Chander.M - Power System Protection and Switchgear - Wiley Eastern, 1994.

8. Y.G. Paithankar – Fundamentals of Power System Protection - PHI

VII SEMESTER B.TECH.(E&E)

EE1706 DIGITAL SIGNAL PROCESSING 4 HRS/WEEK

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT–I

The concept of frequency in continuous time and discrete time signals. The sampling theorem. The Sampling theorem. Analysis of Digital Signals and systems versus Discrete- Time signals and systems. Time domain characteristics of LTI Discrete-Time Systems. Finite-Dimensional LTI Discrete-Time System. Correlation of Discrete-Time Signal, Linear Convolution.

The Discrete-Time Fourier transform, the Discrete Fourier transform, relation between DTFT and DFT and their properties, Inverses, Circular Convolution, Linear Convolution using DFT, the Z-Transform, properties, Inverse frequency response of finite-Dimensional Discrete-time systems, the transfer function, types of transfer function, simple digital filters.

UNIT-II

Sampling of continuous-time signals, Analog low pass filter Design, Design of Analog High pass, Band pass and Band stop filters. Basic FIR and IIR Digital filter structure. Bilinear transformation method of IIR filter Design of low pass IIR Digital filters. Design of High pass, Band stop, and Band pass IIR Digital filters. Spectral transformation of IIR filters. FIR filter Design using windowed Fourier series and with least-mean square error. FFT Algorithm, Dual-tone Multi frequency Signal Detection., Introduction to Multirate and wavelets.

RECOMMENDED BOOKS:

1. Digital Signal Processing – John Prokais

2. Digital Signal Processing – Sanjit. K. Mitra

3. Digital Signal Processing – Ramesh Babu , SCI Tech Publishers

VII SEMESTER B.TECH.(E&E)

ELECTIVE-II

EE1731 **4 HRS/WEEK**

FUZZY LOGIC AND EVOLUTIONARY ALGORITHMS

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Fuzzy set: Definitions of classical & Fuzzy set, Representation of fuzzy sets, fuzzy measure, cardinality of a fuzzy set, α-cuts, normalised fuzzy set, height of a fuzzy set, Basic set theory operations on fuzzy set, Algebraic operations on fuzzy set, Logical operations on fuzzy set.
Fuzzy relation: Fuzzy relations, operations on fuzzy relations, Fuzzy Cartesian product and composition, equivalence relation, binary relation on fuzzy sets, properties.
Membership Function: Features of membership function, Fuzzification, Membership function shapes, assignment of membership function to fuzzy variables, evaluation of membership function
Fuzzy logic: Tautologies, Contradiction, equivalence, logical proofs, fuzzy logic, approximate reasoning
Fuzzy Rule Base System: introduction, Natural language, Design of fuzzy membership function, design of predicates, rule based system, formation of control rules
Fuzzy to Crisp Conversion: defuzzification techniques, Lambda cuts, defuzzification methods-application, comparison and evaluation of defuzzification methods.
Fuzzy Model & Control system: Fuzzy models, structured fuzzy models, stability analysis of fuzzy model based control system, case studies.(classification of equivalence relations, fuzzy classification, fuzzy pattern recognition, multi feature pattern recognition)

UNIT-II

Fundamentals of Genetic Algorithms: Basic concepts, Creation of Offsprings, Working Principle, Encoding, Fitness Function, Reproduction
Genetic Modelling: Inheritance Operators, Cross Over, Inversion and Deletion, Mutation Operator, Bit-wise Operator, bit-wise operator used in GA, generational cycle, convergence of Genetic Algorithm, Application, Multi-Level Optimization, Differences and Similarities between GA and Other traditional Method.
Fuzzy Logic Controlled Genetic Algorithms: Soft computing tools, Problem description of optimum design, Fuzzy constrains, Illustrations, GA in Fuzzy Logic Controller Design, Fuzzy logic controller, FLC-GA based structural Optimization. Identification of dynamic system model with G.A, familiarization of F.L. & G.A Toolbox of MATLAB.
Advanced Optimization Techniques: Basic concept of Ant colony optimization, particle swarm optimization, Tabu search optimization method, difference between PSO&GA.
Application of Fuzzy logic and Genetic Algorithms: At least TWO applications in detail are to be taught.

RECOMMENDED BOOKS:

1. Neural Networks, Fuzzy Logic and Genetic Algorithms Synthesis and Application by S. Rajasekaran , G.A. Vijayalakshmi Pai. PHI 2003.
2. Fuzzy Logic with Engineering applications by Timothy J. Ross. Wiley, 2005
3. Neural Network Design: Martin T Hagon, Howard B Demuth Mark Beale, Thomson learning 2005.

VII SEMESTER B.TECH.(E&E)

ELECTIVE-II

EE1741 MACHINE LEARNING 4 HRS/WEEK

UNIT-I

Introduction to AIo
Overview: Foundations, Scope, Problems, Approaches Of AI.

Intelligent Agents: Reactive, Deliberative, Goal-Driven, Utility-Driven, Learning Agents Artificial Intelligence Programming Techniques

Machine Learning and Knowledge Acquisition: Artificial Neural Network Learning From Memorization, Examples, Explanation, and Exploration. Learning Nearest Neighbor, Naive Bayes, and Decision Tree Classifiers, Q-Learning for Learning Action Policies, Applications. Sample Applications of AI, Student Project Presentations.

Problem-Solving Through Search: Forward and Backward, State-Space, Blind, Heuristic, Problem-Reduction, A, A*, AO*, Minimax, Constraint Propagation, Neural, Stochastic, and Evolutionary Search Algorithms, Sample Applications.

UNIT-II

Knowledge Representation and Reasoning: Ontologies, Foundations of Knowledge Representation and Reasoning, Representing and Reasoning About Objects, Relations, Events, Actions, Time, and Space; Description Logics, Reasoning With Defaults, Reasoning About Knowledge, Sample Applications.

Planning: Planning As Search, Partial Order Planning, Construction and Use of Planning Graphs

Representing and Reasoning With Uncertain Knowledge: Probability, Connection to Logic, Independence, Bayes Rule, Bayesian Networks, Probabilistic Inference, and Sample Applications.

Decision-Making: Basics of Utility Theory, Decision Theory, Sequential Decision Problems, Elementary Game Theory, Sample Applications.

RECOMMENDED BOOKS:

1. Artificial Intelligence: A Modern Approach, Third Edition, Stuart Russell & Peter Norvig, Pearson Education Inc.
2. Machine Learning, Tom Mitchell, McGraw Hill
3. Introduction to Machine Learning, Ethem Alpaydin, MIT Press
4. Probabilistic Graphical Models, Principles and Techniques, Daphne Koller & Nir Friedman, MIT Press
5. Probabilistic Reasoning in Intelligent Systems, Judea Pearl, Morgan Kaufmann

VII SEMESTER B.TECH.(E&E)

ELECTIVE-II

EE1734 **4HRS/WEEK**

MODERN POWER CONVERTERS

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Introduction to switched mode power converters
Generalized comparison between switched mode and linear DC regulator; Operation and steady state performance of Buck, Boost, Buck-Boost and Cuk Converters in continuous-conduction mode, discontinuous- mode and boundary between continuous and discontinuous mode of operation; Output voltage ripple calculation; Effect of parasitic elements.

DC-DC converters with Isolation
Fly back converters and its topologies; Forward converters - Switching transition; Push-pull converter-Switching transition, limitation of the push-pull circuit; Half-bridge and Full bridge DC-DC converters – their switching transitions.

Resonant Converters
Introduction and classification; Load resonant - series and parallel loaded converters in continuous and discontinuous mode of operation; Hybrid resonant DC-DC converters; zero current switch (ZCS); zero voltage switch(ZVS); ZCS- clamped voltage converters(ZCS-CV).

Single - Phase AC-DC Converters
Half wave- bridge converters; its operation with RL and back-EMF loads; performance with free-wheeling diode; Full-wave controlled-bridge rectifier with controlled free wheeling, effect of source inductance.

Three - Phase AC-DC Converters
Trigging sequence, self starting, operation, transformer connections and ratings; DC magnetization, Dual converters.

UNIT-II

DC-AC Converters
Voltage source and current source inverter; single-phase and three-phase bridge inverters; square wave operation, 120 and 180 degree modes; potential diagrams.

PWM Inverters
Voltage control, Unipolar and Bipolar voltage switching, Harmonic reduction.

PWM Technique
Current regulated (Hysteresis) Modulation; Selective harmonic elimination; sine triangular modulation; linear modulation; over modulation; harmonics in the output voltage, stair case PWM, space vector modulator.

Cycloconverters and AC regulators (Three-phase and single-phase).

Power conditioners and uninterruptible Power supplies
Types of UPS- Redundant and Non-Redundant UPS.

RECOMMENDED BOOKS:

1. Mohan, Undeland, Robbins_Power Electronics: Converters, Application and Design, John Wiley & sons, 1989
2. A.I. pressman- Switching mode power supply design-MGH, 1992
3. M.H. Rashid- Power Electronics, PHI, 2004

VII SEMESTER B.TECH.(E&E)

ELECTIVE-II

ADVANCED METHODS IN CONTROL THEORY

EE1735 **4HRS/WEEK**

Questions to be set (4 from each of UNIT-I & UNIT-II)

(Answers to be given total 5 attempting at least 2 from each of UNIT-I and UNIT-II)

UNIT-I

Linear algebra: Vector Spaces, Linear Independence, Basis, Linear Transformations, Projections, Orthogonal / Orthonormal Bases, Gram-Schmidt orthogonalization. Singular value Decomposition (SVD), LQR Factorization.

Signals and Systems: Signal Spaces – L_2, L_∞, Hardy spaces. System and their Norms– Transfer Matrices, ∞ - norm and 2- Norm, Induced Norms. Computation of H_2 and H_∞ norms, Henkel matrix norm

State space design: System description, System description, pole placement design using state feedback, tracking problem, observer design, introduction to reduced order observer. MATLAB implementation.

Robust Control: Elements of Robust control theory, Design objectives and specifications, shaping the loop gain. Structured and unstructured uncertainty, internal stability, small gain theorem, sensitivity and complementary sensitivity function. LFT (Linear Fractional Transformation) technique, μ-synthesis, robust stability of μ-Δ structure.

UNIT-II

H_∞ Control – Problem formulation, output feedback, full state information control, disturbance feedforward, output estimation, separation theory and controller interpretation. H_∞ loop shaping design procedure. Model Matching Problem: Unit feedback configuration, two parameter configuration, plant i/p, plant o/p, Disturbance rejection and performance, Diophantine equations.

Control and stability of time-delay system using Smith-Predictor Form. MATLAB implementation. Kharitonov Approach: Mikhailov Theorem, different types of uncertain polynomials, zero exclusion theorem, Kharitonov theorem.

Calculus of variations: Fundamental concepts. Functional of single function - Euler - equation-General variation of a functional-Functionals of several independent functions- Boundary conditions. Variational approach to optimal control.

Linear quadratic optimal control – Problem formulation, Finite time linear quadratic regulator, Infinite time LQR. LQR tracking system. Kalman Filtering.

Advance and Relevant Topics (at the discretion of the subject teacher)

VII SEMESTER B.TECH.(E&E)

ELECTIVE-II

EE1736 **4 HRS/WEEK**

FLEXIBLE AC TRANSMISSION SYSTEMS

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

AC Transmission Line and Reactive Power Compensation: Analysis of Uncompensated AC line, Passive Reactive Power Consumption, Compensation by a Series Capacitor Connected at the Midpoint of the line, Comparison between Series and Shunt Capacitor, Compensation by STATCOM and SSSC.

Static Var Compensator: Analysis of SVC, Configuration of SVC, SVC Controller, Voltage Regulator Design, Harmonics and Filtering, Protection Aspects, Modelling of SVC, Application of SVC.

Thyristor and GTO Controlled Series Capacitor: Basic concepts of controlled series capacitor, Operation of TCSC, Analysis of TCSC, Control of TCSC, Modelling of TCSC for stability, GTO controlled series capacitor, Mitigation of Subsynchronous resonance with TCSC and GCSC

Static Phase Shifting Transformer: Basic Principle of PST, Configuration of SPST, Improvement of Transient stability using SPST, Damping of Low Frequency Power oscillations.

Static Synchronous Compensator (STATCOM): Principle of STATCOM, analysis of STATCOM, analysis of 6-pulse VSC using switching function, multi-pulse converters, multilevel, voltage converters, harmonic transfer and resonance in VSC.

Static Synchronous Series Compensator: Operation of SSSC and the control of power flow, modeling and control of SSSC, SSSC with energy source, analysis of SSR with a SSSC.

UNIT-II

Unified Power Flow Controller and other Multi-Converter Devices: Operation of UPFC, control of UPFC, Protection of UPFC, Interline power flow controller, convertible static compensator, modeling of UPFC, IPFC and other Multi-converter FACTS, SSR characteristics of UPFC
Interphase Power Controller and other FACTS Devices: Interphase power controller, NGH SSR Damping scheme, thyristor controlled braking resistor, Fault current limiter, thyristor controlled voltage limiter
Power Oscillation Damping: Basic Issues in the Damping of Low frequency Oscillations in Large Power Systems, System Modelling for small signal stability, design of damping controllers, modal transformations of swing equations, Damping of Power oscillations using series FACTS controllers, Damping of Power oscillations using shunt FACTS controllers.

RECOMMENDED BOOKS:

1. FACTS controllers in Power Transmission and Distribution, K.R.Padiyar, New Age Publication.
2. Power Electronics Control in Electrical Systems, Acha & Agelidis, Elsevier.

VII SEMESTER B.TECH.(E&E)

ELECTIVE-II

EE1737 **4HRS/WEEK**

DIGITAL IMAGE PROCESSING

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Introduction: DIP Fundamentals, Steps of DI Processing System.
Elements of digital image processing: Image acquisition, storage, processing, communication, display.
Some basic relationships between pixels: Neighbors of a pixels, connectivity, labeling of connected components, relations, equivalence and transitive closure, distance measures, arithmetic/logic operations.
Some basic mathematical concepts: Convolution and correlation, sampling, FFT algorithm, the inverse FFT, Walsh transform, Hadamard transform, Discrete cosine transform, The Haar transform, The Slant transform, Wavelet transformation.
Image enhancement:
Enhancement by point processing: Some simple intensity transformation, histogram processing, image subtraction, image averaging.
Spartial filtering: Background, smoothing filters, sharpening filters
Enhancement in the frequency domain: Low pass filtering, high pass filtering, homomorphic filtering
Color image processing: Color fundamentals, color models, pseudo color image processing, full color image processing
Image restoration: Degradation model: degradation model for continuous functions, discrete formulation

UNIT-II

Algebraic approach to restoration: Unconstrained restoration, constrained restoration, inverse filtering, restoration in the spatial domain
Image compression: Coding redundancy, interpixel redundancy, psychovisual redundancy, Fidelity criteria
Image compression models: The source encoder and decoder,the channel encoder and decoder
Error free compression: Variable length coding, bit plane coding, lossless predictive coding
Lossy compression: Lossy predictive coding, transform coding, image compression standards
Image segmentation: Edge detection, Line detection, Curve detection, Detection of discontinuities, edge linking and boundary detection, extraction, thresholding, region orientated segmentation, recognition and interpretation
Case study using MATLAB.
Research based topics.

RECOMMENDED BOOK:

Rafael C. Gonzalez, Richard E. Woods “Digital Image Processing

VII SEMESTER B.TECH.(E&E)

ELECTIVE-II

EE1742 **VLSI DESIGN** **4HRS/WEEK**

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

Unit-I

Introduction to VLSI Systems, MOS Transistor – Current versus voltage relationships, Threshold voltage, Pass transistor, Transmission gate, Basic DC equations, nMOS inverter, MOS transistor circuit model, BiCMOS inverter, Steered input to an nMOS inverter, Depletion mode and enhancement mode pull ups, CMOS inverter, Latch up in CMOS circuits, BiCMOS Latch up susceptibility.

MOS circuit design process – Stick diagram, Design rules and layout, Layout diagram, Symbolic diagram.

Scaling of MOS circuits – Scaling models and scaling factors, scaling factors for device parameters, Limitation of scaling.

Subsystem Design and Layout – Switch logic, Gate logic, Combinational Logic, Clocked sequential circuits.

Unit-II

BiCMOS technology and circuits – Introduction, BiCMOS technology, Bipolar logic, BiCMOS logic circuits, Complex logic using BiCMOS, Application, Disadvantage.

Logic Synthesis – Introduction, Transistor level synthesis, Logic level synthesis, Block level synthesis, Algorithm, Boolean space, Binary Decision Diagram (BDD), Advantage, Disadvantage.

Design process– Regularity, Design of an ALU Subsystem, 4 bit adder, Manchester Carry-chain, adder enhancement techniques, Multipliers.

Memory, Registers and aspects of system timing – System timing considerations, Commonly used storage/memory elements, Forming arrays of memory cells.

Practical aspects and testability – Optimization of nMOS and CMOS inverters, Floor plans/Layout, System delays, Test and Testability.

FPGA – Introduction, Features, Architecture, Basic unit of FPGA, Synthesis, Time, area and power analysis.

RECOMMENDED BOOKS:

1. Douglas A. Pucknell, Kamran Eshraghian, Basic VLSI Design, Third Edition, PHI Learing Pvt. Ltd., New Delhi
2. Debaprasad Das – VLSI Design, Third Edition, Oxford University Press.
3. Sung-Mo (Steve) Kang, Yusuf Leblebici – CMOS Digital Integrated Circuits: Analysis and Design, Third Edition, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

VII SEMESTER B.TECH. (E & E)

ELECTIVE-III

EE1738 **4HRS/WEEK**

HIGH VOLTAGE ENGINEERING

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Breakdown in gaseous dielectrics: Breakdown mechanism in gaseous dielectrics-Ionization and decay process – Townsend's criterion – Streamer mechanism of spark-Paschen's Law – Breakdown in Electro negative gases – Breakdown in high vacuum.
Breakdown in solid dielectrics: Intrinsic – Streamer – Electromechanical – Thermal mechanism of breakdown.
Breakdown in liquid dielectrics: Electronic – Cavitation – Thermal Suspended particle mechanism of breakdown.
Generation of High Voltages and Currents.
Alternative Voltage: Transformers in Cascade – Series resonant circuit – Resonant transformer.
Transient Voltage: Single stage and multi stage impulse generators – Synchronization with CRO – Trigatrion gap.
Switching Surges: Tesla coils.
Direct Voltages: Voltage doubler and multiplier circuits – Van-de-Graff Generator.
Impulse Current Generator.

UNIT-II

High Voltage Measurement: Measurement of AC, DC and impulse voltages and current.
Series impedance voltmeters-Generating voltameter – Electrostatic voltmeters – Potential Dividers – Capacitance voltage transformer – sphere gap – Electro optical signal converter – Hall Generator – Resistive shunts – CRO for impulse measurements.
High Voltage Testing: Testing of Insulators – Power Transformers – Circuit Breakers – Surge deviators – cables – Bushings and Transformer oil – Schering Bridge for loss tangent measurement.

RECOMMENDED BOOKS:

1. Kamaraj & Naidu – High Voltage Engineering – TMH, 1996
2. Kuffel and Abdulla – High Voltage Engineering – Pergomon, 1981.
3. R.S.Jha – A Course in High Voltage Engineering – Dhanpat Rai, 1981.
4. C.L.Wadhwa – High Voltage Engineering – Wiley Easterna Ltd., 1994

VII SEMESTER B.TECH. (E & E)

ELECTIVE-III

EE1739 **4HRS/WEEK**

DATA COMMUNICATION & COMPUTER NETWORKS

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Basic Concepts
Line Configuration Point to Point, Multi point; ***Topology*** – Mesh,Star, Tree, Bus, Ring, Hybrid Topologies; ***Transmission Mode*** – Simplex, Half Duplex, Full Duplex; ***Categories of Networks*** – Local Area Network (LAN), Metropolitan Area Network (MAN), Wide Area Network (WAN)

The OSI Model
The Model Layered Architecture; Function of the layers – Physical Layer, Data Link Layer, Network Layer, Transport Layer, Session Layer, Presentation Layer, Application Layer, Summary of Layer Functions.
TCP/IP Protocol Suite

ISDN:
Concept, evolution, the user interface, objectives, benefits, architecture, standards.
Transmission structure: ISDN channels, subscriber loop technology.
User access: User network interface, access configuration, ISDN protocols.

Encoding and Modulating
Digital to Digital Conversion – Unipolar, Bipolar, Polar
Analog to Digital Conversiom – Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM), Sampling Rate.
Digital to Analog conversion -- Amplitude Shift Keying(ASK), Frequency Shift Keying (FSK), Phase Shift Keying(PSK), Quadrature Amplitude Modulation(QAM), Bit/Baud Comparison.
Multiplexing – Many to one / One to many, Frequency Division Multiplexing (FDM), Wave Division Multiplexing (WDM), Time Division Multiplexing (TDM)
Multiplexing Application – The Telephone System – Common Carrier Services and Hierarchies, Analog Services, Digital Services.
Digital Subscriber Line (DSL) – ADSL, RADSL, HDSL, SDSL, VDSL, FTTC – FTTC in the Telephone Network, FTTC in the Cable TV Network.
Error Detection and Correction
Types of Error – Single Bit Error, Brust Error
Detection – Redundancy, Vertical Redundancy Check(VRC), Longtitudinal Redundancy Check(LRC), Cyclic Redundancy Check(CRC)
Error Correction – Single Bit Error Correction, Hamming Code, Brust Error Correction

Data Link Control
Line Discipline – ENQ/ACK, Poll/Select
Flow Control – Stop and Wait, Sliding Window
Error Control – Automatic Repeat Request(ARQ), Stop and Wait ARQ, Sliding Window
Local Area Network
Project 802 IEEE 802.1 LLC MAC Protocol Data Unit (PDU)
Ethernet Access Method : CSMA/CD Addressing Frame Format
Token Bus Token Ring Access Method: Token Passing Addressing
FDDI Access Method.

UNIT-II

The IP protocol, IP address, Internet control protocol, Gateway routing protocol, Internet multicasting, UDP protocol, TCP protocol connection establishment, connection release.

Circuit Switching Space Division Switches, Time Division Switches, TDM Bus, Space and Time Division Switching Combinations, Public Switched Telephone Network (PSTN)
Packet Switching Datagram Approach, Virtual Circuit Approach
Message Switching.

Security:
Symmetric Key Cryptography: Traditional Ciphers, Block Cipher.
Public Key Cryptography: Choosing public and private keys
Message Security: Privacy, Message Authentication, Integrity, Nonrepudiation
Digital Signature: Signing the whole document, Signing the digest.

RECOMMENDED BOOKS:

1 Data Communication by Behrouz A Forouzan
2 Computer Networks by Tanenbaum
3. William Stallings: Data and Computer Communication, Max Well, Mc Millan International Ed.
4 Taub & Schilling: Principles of communication systems, Int. student Ed.
5. Siman Haykins: Comm. Systems, Wiley Eastern Edn.
6. B.P.Lathi: Modern Digital and Analog Communication Systems.
7. George Kennedy: Electronic Comm. Systems, TMH.

ELECTIVE-III

EE1740 **4 HRS/WEEK**

BIO-MEDICAL INSTRUMENTATION

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

Objectives: This course delves into the processes of Bio-medical Instrumentation to provide the basic foundation in Bio-medical Instrumentation. All detailed basics required are covered.

Pre-requisites: Anatomy, Physiology, Electro-physological measurement, Medical Imaging and Telemetry

UNIT – I

1. **ANATOMY, PHYSIOLOGY AND TRANDUCERS**

Brief review of human physiology and anatomy – cell and their structures – electrical mechanical and chemical activities – action and resting potential – different types of electrodes – sensors used in biomedicine – selection criteria for transducers and electrodes – necessity for low noise pre-amplifiers – difference amplifiers – chopper amplifiers – electrical safety – grounding and isolation.

2. **ELECTRO-PHYSIOLOGICAL MEASUREMENT**

ECG – EEG – EMG – ERG –lead system and recording methods – typical waveforms.

3. **NON-ELECTRICAL PARAMETER MEASUREMENTS**

Measurement of blood pressure – blood flow cardiac output – cardiac rate – heart sound – measurement of gas volume – flow rate of CO_2 and O_2 in exhaust air –pH of blood – ESR and GSR measurements.

UNIT – II

1. **MEDICAL IMAGING AND TELEMETRY**

X-RAY machine – computer tomography – magnetic resonance imaging system – ultra sonography – endoscopy – different types of telemetry system – laser in biomedicine.

2. **ASSISTING AND THERAPETIC DEVICES**

Cardiac pacemakers – defibrillators- ventilators – muscle stimulators – diathermy – introduction to artificial kidney, artificial heart – heart lung machine – limb prosthetics – orthotics – elements of audio and visual aids

TEXT BOOKS:

1. Medical Instrumentation-Application & Design, John G. Webster, Wiley.
2. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer, "*Biomedical Instrumentation and Measurements*", Prentice Hall

3. Geddes L. A. and Baker L. E., "*Principles of Applied Biomedical Instrumentation*", John Wiley.

REFERENCE BOOKS:

1. Richard Aston, "Principles of Bio-medical Instrumentation and Measurement", Merril Publishing Company.

2. Kandpur R. S, “Handbook of Biomedical Instrumentation”, Tata McGraw Hill.

VII SEMESTER B.TECH.(E&E)

ELECTIVE-III (OPEN ELECTIVE)

EE1721 **4 HRS/WEEK**

WAVE GUIDES AND ANTENNA

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

Transverse Magnetic and Electric waves in Rectangular Guides, Impossibility of TEM Wave in Wave guides, Solution of the field Equations, TM and TE Waves in Circular Guides, Wave Impedances and characteristic Impedances, Transmission Line Analogy for wave Guides, Attenuation factor and Q of Wave Guides. Dielectric slab wave Guides.

Interaction of Fields and Matter:

Space-Charge-Limited Diode, Plasma Oscillations, Wave propagation in a plasma, Polarization of Dielectric Materials, Equivalent volume and surface charges, the permittivity concept, Magnetic Polarization, Equivalent Volume and surface currents, The permeability concept, Frequency response of Dielectric Material.

UNIT-II

Potential functions and the electromagnetic field. Potential function’s for Sinusoidal Oscillation. The alternating current element, Power Radiated by a current element, Application to short Antennas. Assumed current distribution, Radiation from a Quarter-Wave Monopole or Half-Wave Dipole. Sine Integral and Cosine Integral, Electromagnetic field close to an antenna, Solution of Potential Equations far field Approximation.

Antenna Fundamentals.

Antenna Arrays.

Note: *This subject is offered and taught by the Department of Electronics & Communication Engineering.*

VII SEMESTER B.TECH. (E & E)

ELECTIVE-III (OPEN ELECTIVE)

EE1722 **4HRS/WEEK**

REAL TIME EMBEDDED SYSTEMS

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT-I

General features of Embedded System, basic components, processors technologies, I.C. technologies, software tools**.**

Memory: SRAM, DRAM, memory hierarchy and cache, cache mapping, writing, advanced RAM. Power & display devices.

Basic networking, communication & protocol concept, parallel & serial communication buses, intercommunication and networking.

Device Drivers, Multiple processes, Task, Threads.

UNIT-II

Introduction to Operating System, Time-sharing systems, Real time Systems.

Real-Time Operating Systems: System structure, Kernel, management & scheduling

Typical embedded system designing, software programming and system testing, Selected application case studies from areas such as Power Electronics System, Control and actuator system etc.

RECOMMENDED BOOKS:

1. Raj kamal- Embedded Systems – Tata McGraw-Hill,2004
2. F. Vahid, T. Givargis- Embedded System Design-John Wiley &Sons,Inc. 2002
3. Goldsmith Sylvia, "A Practical Guide to Real-Time Systems Development", Prentice Hall.
4. David Simon, "An Embedded Software Primer," Addison Wesley, 1999
5. Philip A.Laplante, "Real Time System Design and Analysis", IEEE CS Press

VII SEMESTER B.TECH. (E & E)

EE1704 **4HRS/WEEK**

ELECTRICAL MACHINE DESIGN

No. of questions to be set: 8 (Four from each unit)
No. of questions to be answered: 5 (Minimum of two questions from each unit)

UNIT - I

Principal Laws and Methods in Electrical Machine Design - Electromagnetic Principles, Application of the Principle of Virtual Work in the Determination of Force and Torque, Maxwell's Stress Tensor; Radial and Tangential Stress. Windings of Electrical Machines- Basic Principles, Salient-Pole Windings, Slot Windings, End Windings, Phase Windings Design of Magnetic Circuits- Air Gap, Core Length, Magnetic Materials of a Rotating Machine, Permanent Magnets, Flux Leakage, Resistances, DC Resistance, Influence of Skin Effect on Resistance.

UNIT – II

Main Dimensions of a Rotating Machine- Mechanical, Electrical and Magnetic Loadability, Air Gap. Design Process and Properties of Rotating Electrical Machines- Asynchronous Motor, Synchronous Machine. Insulation of Electrical Machines - Dimensioning of an Insulation. Heat Transfer- Losses, Heat Removal, Thermal Equivalent Circuit.

RECOMMENDED BOOK:

1. Design of Rotating Electrical Machines, Juha Pyrhonen, Tapani Jokinen, Valeria Hrabovcova, John Wiley & Sons, Ltd.

2. A Course in Electrical Machine Design, A.K.Sawhney, Dhanpat Rai.

3. The Performance and Design of Alternating Current Machines- M. G. Say, CBS Publisher.

VII SEMESTER B.TECH.(E&E)

EE1761 **3 HRS/WEEK**

ELECTRICAL DRIVES LAB

1. AC 3phase motor speed control demonstration with feedback Tacho-generator.
2. Three Phase PWM based AC drive demonstration.
3. AC Servo Motor (Speed Torque) Demonstration.
4. DC drive demonstration with mechanical loading effects.
5. DC motor speed control with open-loop and Tacho-generator feedback modes.
6. Modeling of three phase Induction motor in MATLAB/SIMULINK.
7. Simulation of V/f control of three phase Induction motor.
8. Simulation of Direct Torque Control of VSI fed three phase Induction motor.
9. PLC based Automation.
10. Simulation of DC motor drive with loading effects.

VII SEMESTER B.TECH.(E&E)

EE1762 **3 HRS/WEEK**

ADVANCED MICROCONTROLLERS & EMBEDDED SYSTEM LAB

(1) Realisation of adder and subtracter circuitry and its implementation on the kit.
(2) Implementation of a 4:1 multiplexer using 2:1 multiplexers.
(3) Implementation of a generic parity detector.
(4) Implementation of flipflops(D,JK,T).
(5) Implementation of 4 bit (asynchronous and synchronous) counters.
(6) Implementation of a comparator using (a) behavioural (b) dataflow (c) structural.
(7) Calculation of a factorial of a number.
8) Implementation of code converter circuitry and their corresponding realization.
(9) Implementation of binary to decimal vice-versa conversion circuitry and their realization .
(10) Implementation of carry look ahead adder circuitry.

Extra Experiments (beyond course curriculum)

(11) Implementation of a state machines using using VHDL.
(12) Implementation of an ALU circuitry.

VII SEMESTER B.TECH.(E&E)

EE1771 MINI-PROJECT

TOTAL CREDIT: 2

VII SEMESTER B.TECH. (E&E)

EE1772 INDUSTRIAL TRAINING

TOTAL CREDIT = 1

VIII SEMESTER B. Tech. (E&E Engg.)

EE1875	**MAJOR PROJECT**	**TOTAL CREDIT: 16**