EE 543: Computer Oriented Numerical Methods:

L T P
(3-1-3)
Theory: 100
Sessional: 50
Lab: 50

1. Computer Arithmetic:

Introduction, Floating point representation of numbers and floating point arithmetic, computational errors, Relative and absolute errors, Error propagation, Iterative processes-convergence and acceleration.

2. Iterative methods:

Transcendental equations, Methods of bisection, Method of false position, Newton Raphson method, Complex roots, Synthetic division.

3. Matrices and Linear Systems of Equations:

Matrix inversion, LU decomposition, Solution of linear system of equations by direct methods—Gauss elimination method, ill—conditioned system, Pivotal condensation, Gauss-Siedel iteration method, Gauss-Jordan matrix inversion, Eigen values and Eigen vectors, N—R method for non-linear system of equations.

4. Finite Difference and Interpolation:

Forward difference, Backward difference and central difference, Symbolic relations, Interpolation with equal intervals, Interpolation using forward difference, Newton's and Gauss's formula for interpolation, Interpolation with unequal intervals, Newton's formula, Lagrange's polynomial interpolation.

5. Numerical Differentiation and Integration:

Differentiation by polynomial fit, errors in numerical differentiation, numerical integration—Trapezoidal rule, Simpson's rule, Romberg method.

6. Ordinary Differential Equations:

Taylor's series method, Euler's method, Modified Euler's method, Runga-Kutta method, Predictor-Corrector method.

**Note: Stress should be given on developing algorithms for the numerical methods. Sessional and laboratory work should consist of writing computer programs using these algorithms and running them on the computer.

Books for CONM

1. Numerical Methods for Scientific and Engineering Computation: M. K. Jain, S.R.K. Iyengar, R.K. Jain., New Age International
2. Numerical Methods -Principles, Analysis, and Algorithms : Srimanat Pal, Oxford
3. Numerical Methods in Science and Engineering - A Practical Approach: S Rajasekaran, S.Chand
4. Numerical Methods with programming in C: T Veerarajan, T Ramachandran, TMH
5. Introductory Methods of Numerical Analysis: S.S. Sastry, PHI

EE 542: Control System (EE/IE)

L T P
3 - 1 - 3
Max. Marks = 100
Sessional = 50
Lab =50

1. **Elementary concepts of control systems:** Definition, open loop and closed loop systems, examples of control systems, linear, non-linear, time-invariant and time variant, continuous and discrete control system, block diagram representation of control systems.

2. **Models of physical systems:** Transfer function: definition and properties, formulation of differential equations for physical systems and derivation of transfer function: mechanical and electrical systems, derivation of transfer function using block diagrams reduction techniques and signal flow graphs, signal flow graph from block diagram.

3. **Introduction to control system components:** Error detectors, servo motors, techno-generators, servo amplifiers and determination of transfer functions.

4. **Time domain analysis:** Standard test signals - step, ramp, parabolic and impulse signals, poles, zeros and characteristic equations, relation between s-plane root locations and transient response, time response of first order and second order systems, performance specifications in time domain, derivative and integral control and their effects on the performance of the 2^{nd} order systems, system types and error constants, generalized error coefficients, transient response of higher order systems (outline only).

5. **Stability analysis:** Concepts of control system stability, Routh-Hurwitz stability criterion, scopes and limitations of the criterion, root-locus techniques, system analysis and design using root-locus technique.

6. **Frequency response analysis:** Frequency response and its specifications, stability analysis using frequency response plots: Bode plot, polar plot, log-magnitude vs phase plots and Nyquist plot, Nyquist stability criterion, M and N circle.

7. **Compensation Techniques:** Preliminary design specifications in time and frequency domain, gain compensation, lead and lag compensation.

Books:

1. Control Systems Engineering by Nagrath and Gopal
2. Modern Control Engineering by Ogata
3. Automatic Control Systems by Kuo
4. Control Systems by A Anand Kumar
5. Control Systems Engineering by Salivahanan, Rengaraj and Venkatakrishnan
6. Control System Components by Gibson and Teylor

EE 541: DIGITAL ELECTRONICS AND SYSTEMS (EE/IE)

L T P
3 1 3

Max. Marks = 100
Sessional Marks = 50
Laboratory Marks = 50

1. **Number system**:

   Representation of Binary numbers, octal and hexadecimal numbers, complements, signed binary numbers, Binary codes, floating point numbers and arithmetic and the conversion process.

2. **Boolean algebra and logic gates:**

   Basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms-SOP & POS. Logical operations, truth tables, logic gates, logic levels and pulse waveforms, pulsed operation.

3. **Simplification of Boolean functions:**

   The map method- the Karnaugh map, minimal SOP & POS, Don't care conditions, multiple output minimization, tabular method, Quine-Mcclusky method, determination and selection of prime implicants.

4. **Combinational Logic:**

   (Logic synthesis): Introduction, universal property of NAND and NOR gates, AND-OR networks, NAND & NOR networks, EX-OR networks, design and analysis of combinational logic.

5. **Functions of combinational logic:**

   Adders & substractors, parallel binary adders, magnitude comparator, code conversion, decoders & encoders, Multiplexer & demultiplexers, parity generators & checkers. Read only memories PLA & PAL

6. **Synchronous sequential logic: Introduction:**

   S-R, J-k, D and T Flip Flops, Excitation table, Triggering of F/Fs & Latches, One shot Astable multivibrator. Registers: - Shift – Registers, Ripple Counters, Synchronous Counters. Ring Counters, Timing Sequences, Design Procedure, Random Access Memory, Memory Decoding.

7. **Digital integrated Circuit:**

   Introduction, special characteristics (Fan-Out, Power dissipation, Propagation delay, figure of merit, noise level) Introduction to TTL, ECL, MOS, and CMOS circuit.

Books:

1. Digital Design – M. Marris Mano.
2. Logic Design Theory – NN Biswas
3. Digital Fundamental – TL Floyd
4. Digital Electronics- R.P.Jain.

EE 545: Electrical Machine - II

L T P
3 1 0
Max. marks = 100
Sessional = 50

1. Poly-phase Induction Motors:

Constructional features – slip ring and squirrel cage motors. Rotating magnetic field and operation of poly-phase induction motors, Equivalent circuit and phasor diagram. Torque and Power, Speed-torque curves – effects of rotor resistance, Deep-bar and double cage rotors, Performance calculation from circle diagram, Method of speed control, Losses and efficiency, Applications, Induction generator and induction regulator, Starting of induction motor.

2. Single phase induction motors:

Construction, Rotating and cross field theories, Equivalent circuit, Speed-torque characteristic, Starting methods.

3 . Synchronous Machines:

Construction and principles of operation of synchronous generators and motors. Ventilation and cooling, Armature windings, winding factors, emf equation. Armature reaction, leakage reactance, synchronous reactance, and impendence of non-salient pole machines. Short circuit and open circuit tests, short circuit ratio, M M F in salient and non-salient pole machines. Calculation of regulation by synchronous impedance method. MMF method and ASA method.

Introduction to two-reactance theory, locus diagram of synchronous impedance, slip test, damper winding and oscillation of synchronous machines, Synchronization, power angle diagram and synchronizing power. Determination of sub-transient and transient react races and time constants of synchronous machine by different methods. Determination of sequence impedances of synchronous machine. Parallel operation.
Synchronous motor: Phasor diagram, effect of varying excitation, effect of load variation, V-curve, O-curve, power angle diagram and stability, Hunting, Two-reaction theory of salient-pole motor, Starting. Use as synchronous phase modifiers.

4. A.C. commutator motors:

Construction and functions of the commutator.
3-phase commutator motor: Effects of voltage injection into the rotor circuit of a polyphase induction motor. Construction and operation of the Schrage motor. Effects of brush movement.
1-phase commutator motors: Universal and repulsion motors: Construction and principle of operation, Starting methods, Speed control, Improvement of commutation and power-factor by compensation.

5. Reluctance motors:

Construction and principle of operation, Synchronous and sub-synchronous operation, Effects of frequency and rotor resistance, Types of reluctance motor, Speed-torque characteristic.

6. Stepper motor:

Construction and principle of operation, Types, Characteristics, Selection and Application.

7. Servomotors:

Construction and principle of operation of AC and DC servomotors. Types, Damping in AC servomotors, Application.

REFERENCES:

1. Theory of Alternating Current Machinery: Langsdorff, A.S. MC-Graw Hill.
2. Electrical Machines: Nagrath I.J. and Kothari D.P. Tata MC-Graw Hill
3. Electrical Machines: Mukherjee P.K. and Chakravarty S. Dhanoat Rai.
4. Advanced Electrical Technology: Cotton H.
5. The Performance and Design of AC Commutator Machines: Taylor E.O. Wheeler.
6. Fractional and Sub-fractional H.P. Electric Motors: Veinott G.C. and Martin J.E. MC-Graw Hill

EE 544: ELECTRIC POWER SYSTEM – I

L T P
3 1 0
Theory Marks =100
Sessional Marks = 50

1. General Introduction:

Introduction to power system: Generation , transmission and distributions and basic layout arrangement of an inter-connected power system.

2. Distribution:

Different systems and their comparison based on relative copper efficiencies, Concentrated and distributed loads in radial distributors fed at one and both ends. Ring mains. Stepped distributors, sub mains, feeders. Design of distributors, feeder and distribution substation.

3. Line constants:

Resistance – Conductor materials. ACSR expanded ACSR, hollow and bundle Conductors. Use of standard wire tables. Inductance- Inductance of solid cylindrical conductor, composite conductor. Concept of G.M.D. Inductance of single conductor with ground return, 2-conductor single phase line, inductance of three phase single circuit and double circuit lines with symmetrical and unsymmetrical spacing. Skin effect and proximity effect. Bundle conductors. Internal impedance of conductor. Bessel real and Bessel imaginary.

Capacitance- Capacitance of isolated conductor, 2-conductor single phase line, three phase single circuit and double circuit lines with symmetrical and unsymmetrical spacing. Method of image and effect of ground. Charging current.

4. Performance of Transmission Lines:

Performance of short- length and medium- length lines: Nominal- T and Nominal- pi representation. Performance of long transmission lines. Interpretation of the long- line equations. SIL. Ferranti effect. Generalized line constants and their application. Receiving- end, sending- end and universal Power-circle diagrams. Calculation of synchronous phase modifier capacity (SPM).line regulation. Maximum power limits. Efficiency of transmission line.

5. Mechanical design:

Supporting structure for overhead lines. Towers(A,B,C,D and DE types), Disposition of conductors, spacing between conductors, length of span, calculation of sag and tension for equal and unequal suspension levels. Stringing chart, sag template, vibration and vibration damper.

6. Insulators:

Different types of insulators. Leakage path, wet flashover and dry flashover distances, potential distribution over a string of suspension insulators, Methods of equalizing the potential. String efficiency.

7. Cables:

Insulating materials. Construction of single core and multi-core cables, Armouring, laying and jointing.
H.V cables: pressure cables- oil filled and gas filled cables. Stress and capacitance of single core cable, most economical size of conductor. Capacitance and inter-sheath grading. Dielectric stress in bushing insulator. Capacitance and stress in 3 core cable, sheath effects, sheath current, insulation resistance, breakdown voltage and mechanism of breakdown. Thermal characteristics of cables.

8. Corona:

Corona discharge, disruptive corona voltage and visual critical voltage, factors effecting corona, corona power loss, empirical laws, line design based on corona, advantages and disadvantages of corona, radio interference, inductive interference between power and communication lines

REFERENCES:

1. Electrical Power—S.L.Uppal.
2. Electrical Power System---C.L.Wadha.
3. Electrical Power System's design—M.V. Despande.
4. Switchgear principles—P.H.J.Crane.
5. Switchgear and Protection—S.S. Rao
6. Switchgear and Protection-- M.V. Despande.