

**ELECTRICAL ENGINEERING
SECOND YEAR**

121201 MATHEMATICS III

FIRST TERM:

1. **Ordinary Differential Equations and some Special Function:** Series solutions ordinary differential equations, Legendre and Bessel function and their properties.
8 Lectures
2. **Partial Differential Equations:** Second order linear and quasi-linear partial differential equations, elliptic, parabolic and hyperbolic types, boundary and initial conditions solutions of Dirichlet and Neumann problems for Laplace equation and of heat conduction problems by Fourier method, D'Alembert solution of 1-D wave equation and solution of Cauchy problem.
8 Lectures
3. **Functions of a Complex Variable:** Review of complex numbers, formulae of Euler and De Moivre, analytic functions, Cauchy Riemann conditions elementary complex functions and analytic function in terms of a power series, Laurent series, residue theorem, contour integration.
8 Lectures

SECOND TERM:

Probability and Statistics: Axiomatic definition of probability, laws of probabilities classical occupancy problem with illustrations, conditional, probability

multiplication law, independence of events, Bayes rule, discrete and continuous random variables-cumulative distribution functions, probability mass function, probability density function, mathematical expectation, mean, variance, moment generating function and characteristic function, standard probability models-binomial, Poisson, exponential, Weibull, normal and log normal, sampling and sampling distribution z , t , Chi-square and F , estimation of parameters, use of t , Chi-square and F in test significance. 24
Lectures

BOOKS RECOMMENDED:

TEXT BOOKS:

1. Advance Engineering Mathematics by E. Kreyszig, Wiley eastern Pvt. Ltd. (India)

REFERENCE BOOKS:

1. Advance Engineering Mathematics by C.R. Wysle
2. Mathematics of Physics and Modern Engineering by Sckolonikoff & Redhelfer
3. Advance Mathematics for Engineers and Physicists by L.A. Pipes

121202 COMPUTATIONAL TECHNIQUES

FIRST TERM:

1. **Types of Computer:** Digital, analog and hybrid, organization of a digital computer system-CPU memory, I/O devices, representation of numbers-integer and floating point arithmetic, round off errors and their propagation.
2. **Introduction to computer languages:** Assembly language, higher languages compilers, problem solving using computers algorithm, flow chart, examples, FORTRAN programming, constant and variables, arithmetic expression I/O statements, specification statement, control statements, subscribed variables, logical expression, function and subroutines, examples of programming should include numerical as well as non-numeric matrix operations, searching, sorting etc.
3. **Iterative Techniques for solution of equation:** Simple iteration scheme, Newton-Raphson method, secant method, their rates of convergence, order of errors, etc. roots of polynomial equation, Gaussian elimination, Gauss-Siedel iteration, matrix inversion by Gaussian method, computation of determinant, polynomial approximation.

SECOND TERM:

Lagrangian interpolation of polynomial, Aitkin's methods, method, Newton's forward difference formula, curve fitting (least square), Trapezoidal method,

Simpson's Rule, order of errors in integrations, solutions of initial value problems, Euler's methods, and 4th order Runge Kutta (algorithm only).

COMPUTATIONAL LABORATORY

FIRST TERM:

Familiarization with PC and DOS, preparing ASC II files using editors/word processors, system utilities, compiling and running, programme development in FORTRAN, number theoretic problems, series summation, matrix and vector operation, non-numeric data processing, searching and sorting.

SECOND TERM:

Numerical techniques finding roots of a function, quadrature, integration and solution of differential equations, interpolation and curve fitting solution of linear simultaneous equations and matrix inversions

TEXT BOOKS:

1. Computer Programming & Numerical Methods (For Engineers) by Swami Saran, P.K. Swami and K.K. Singh, Sarita Publishers, Meerut
2. Computer Oriented Numerical Methods by V. Rajaram, Prentice Hall of India

REFERENCE BOOKS:

1. Elementary Numerical Analysis by S.D. Conte
2. Introductory Methods of Numerical Analysis by S.S. Shastri
3. Numerical Methods in Engineering by M.G. Salve
4. Computing for Engineering by R. T. Fennes

104203 BASIC ELECTRONICS

FIRST TERM:

P-n junction, Depletion layer, Barrier potential, forward and reverse bias, breakdown voltage, p-n Characteristics of p-n junction diode knee voltage, load line and opt ideal p-n junction diode, junction capacitance, zener diode

Rectifiers and filters-half wave, centre tap full wave and bridge rectifier, percentage of regulation, p-v, ripple factor, C, RC, LC and PI filter, voltage doubler, clipping and clamping ckt voltage regulation

BJT- Introduction, basic theory of operation of PNP and NPN transistor, V-I characteristics, CB, CE and CC configuration, junction FET-introduction, theory of operation, JFET parameters JFET-amplifiers

MOSFET- Introduction, theory of operation MOSFET parameters application. Graphical analysis of BJT and FET circuits, linear models of BJT and FET Pulse and large signal models of BJT and FET

SECOND TERM:

Basic BJT and FET Amplifiers

Introductory idea of multistage and feedback amplifiers

Biasing, base bias, emitter feedback bias, collector feedback bias, voltage divider bias, load line and operating point

Integrated ckt-ideal op-amp, analysis of principle of integration simple op-amp, ckt- intro to digital integrated circuits light source –LED.

Photo detectors- Photo diode and photo transistors, thyristors-introduction to thyristors family, SCR characteristics and ratings

TRIAC- Theory of operation, characteristics and rating voltage control By SCR and TRIAC

UJT- Introduction, basic theory of operation, characteristics and structure, complementary and programmable UJT relaxation oscillator.

103204 NETWORK THEORY

FIRST TERM:

1. Linear time invariant first order circuits
2. Linear time invariant second order circuits
3. Response to an arbitrary input
4. Coupling elements and coupled circuits
5. Network graphs, Tellegen's theorem, loop and cutset analysis

SECOND TERM:

1. State equations
2. Natural frequencies

3. Network functions
4. Two-port networks
5. Definition of positive real function, testing of driving point function
6. Synthesis of one port L-C, R-C and R-L network
7. Two port synthesis and filter design

TEXT BOOKS:

1. Basic circuit theory by Deoser and Kuh, Mc Graw Hill
2. Network theory and filter design by Aatre, Wiley Eastern
3. Network Analysis by Van Valkenburg

REFERENCE BOOKS:

1. Electrical Network Theory by Balbanian and Bickert, John Wiley and Sons
2. Modern Network Synthesis by Van Valkenburg, Wiley Eastern
3. Circuit Theory by TSKV Iyer, Tata Mc Graw

103205 ELECTRICAL MACHINE – I

FIRST TERM:

Single phase Transformer: Construction and principle, e.m.f, equation, Phasor diagram, equivalent circuit, testing of transformer, regulation and efficiency, parallel operation. Auto Transformer, reactance calculation and mechanical stress per unit system

Three Phase Transformer: Transformer connections and vector groups, harmonics, parallel operation, phase conversions and testing of 3-phase transformer, cooling of transformer

D.C. Machine: Constructional features and types of D.C. Machines, windings, basic principle, e.m.f. f., torque and speed equations, Commutation and armature reaction.

SECOND TERM:

D.C. Motor characteristic, starting and speed control, testing and efficiency

Induction Machine: Basic theory and construction, windings Phasor diagram and equivalent circuit. Torque speed characteristics, Effect of Rotor resistance. Testing and circle diagram. Deep bar and double cage motor, starting and speed control. 3 phase A.C. Accumulator motor, (Schrage motor), Induction generator

TEXT BOOKS:

1. Electric Machines— By Fitzgerald and Kingsley (Mc Graw Hill)
2. Electric Machines - By Nagarath and Kothari (Tara Mc. Graw Hill)
3. Alternating current Machine - By M.G. Say

101206 MECHANICS OF SOLIDS-I

FIRST TERM:

- 1. Introduction and fundamental concepts:** Introduction-purpose and scope of the subject, generalized procedure, basic assumption, types of forces (External and Internal forces), method of sections, constitutive laws, Elastic material, Principle of Super position, St. Venant's Principle Tensile test, generalized Hook's law for isotropic and linear elastic material.
5 Lectures
- 2. Simple stress and stain:** Uniaxial tension or compression of a bar (prismatic and non-prismatic), cases of simple shear, shear strain components in terms of shear stress, Bi-axial and tri-axial tension or compression, Thermal stress and strain, statically determinate system of bars in tension (or compression), thin walled pressure vessels, cylindrical and spherical shells.
8 Lectures
- 3. Shearing Force and Bending Moment:** Use of singularity functions in drawing B.M.D and S.F.D.
6 Lectures
- 4. Stress due to bending:** Pure bending of beams, normal stress and shear stress distribution in a beam subjected to both B.M.D. and S.F.D.
6 Lectures

SECOND TERM:

- 1. Deflection due to bending:** Double integration method, moment area method.
4 Lectures
- 2. Torsion:** Torsion of solid and hollow circular shaft, Torsion of a hollow thin walled shaft, closed coiled helical spring Flanged couple.
5 Lectures
- 3. Two-dimensional stress analysis:** Plane stress components on a general plane at a point, Mohr's circle of stress.
6 Lectures
- 4. Cases of combined loading:** Bending with tension (or compression) Eccentrically loaded member, core of section, torsion and shear, torsion and bending cases of transmission shafts subjected to bending tension or axial thrust.
6 Lectures
- 5. Elastic strain energy and its application:** Elastic strain energy of a rod under various kinds of loading-Elastic strain, energy for various states of stress, simple applications, Castiglians Theorem.
4 Lectures

LABORATORY WORK:

Minimum eight experiments bases on the theory covered under the subject.

BOOK RECOMMENDED:

1. Mechanics of Solids – Kazmi
2. Mechanics of Solids – Singh and Jha
3. Mechanics of Solids – Ryder

REFERENCES:

1. Mechanics of Solids – Timoshenko and Gere
2. Introduction to Mechanics of Solids – Grandall and Dahl
3. Mechanics of Solids – Popov

102214 THERMODYNAMICS I

FIRST TERM:

- Sources of Energy:** Solar, fossil, nuclear, geothermal, wind, tidal and bio-mass energy, basic principles of energy conversion, direct and indirect energy conversion methods.
4 Lectures
- Basic Concepts:** Dimensions and units, thermodynamic systems and their properties, Zeroth law and temperature equilibrium concept. 3 Lectures
- First Law of Thermodynamics:** Concept of work and heat, first law applied to open and closed systems, internal energy and enthalpy- flow work examples, gases vapours, Laws of perfect gas, specific heat at constant pressure and constant volume, PVT relations.
- PVT Surface for Steam:** Properties of steam, use of steam tables, simple thermodynamic process involving gases and vapours. 7 Lectures
- Helholtz and Gibb's functions, Maxwell's relations** 3 Lectures
- Second Law of Thermodynamics:** Introduction, Kelvin-plank and classisus statements and their equivalence, reversible cycle-Carnot cycle, Corollaries of second law, classisus inequality entropy as a property, principle of increase of entropy, entropy, and calculation of entropy change in ideal gas processes. 7 Lectures

SECOND TERM:

- Ideal Cycles:** Otto, Diesel, Dual and Joule cycles, comparison of cycle efficiencies.
5 Lectures
- Vapour Cycle:** Carnot and Ranking cycle (use of Moller chart)
2 Lectures
- Non-reacting Mixtures:** Mixture of ideal gases, Dalton's law, mixture of ideal gases and vapour Psychometry, Adiabatic saturation temperature, dbt and wbt, Humidity degrees of saturations, use of Psychometric chart, processes including air-vapour mixtures, evaporative cooling.
7 Lectures
- Combustions:** Combustion processes, Strichiometric reaction equation, mass balance, complete and incomplete combustion analysis, enthalpy and internal energy of reaction, enthalpy of formations, flue gas analysis, Orsat apparatus, higher and lower heating values of fuels.
7 Lectures
- Fuel cells, solar cells and solar collectors M.H.D. conversion**
3 Lectures

BOOKS RECOMMENDED:

TEXT BOOKS

- Engineering Thermodynamics by Balzihiser and M.R. Samuels

REFERENCE BOOKS:

- Thermodynamics by F.W. Seers
- Thermodynamics by R. Prasad and B.K. Singh
- Heat and Thermodynamics by Zemsusky
- Thermodynamics by Reynolds

104215 SOLID STATE PHYSICS AND DEVICES

FIRST TERM:

Semiconductor materials, growth of semiconductors, energy bands in solids, charge carriers in semiconductors, excess carriers in semi conductors, fabrication of p-n junction, forward and reverse biased junction, junction diode, tunnel diode, photodiode, light emitting diodes.

SECOND TERM:

BJT operation and fabrication, minority carrier, distribution, JFET, MOSFET, ICFET, MOS capacitor, MOSFET, UJT, P-N diode, silicon controlled rectifiers, (dv/dt and dv/dt effects), shorted cathode SCRs, diacs and triacs, ruby laser, semiconductor laser

TEXT BOOKS:

Solid State Electronics Devices by B.G. Streetman, Prentice Hall of India Pvt. Ltd

Physics of Semiconductor Devices by S.M. Sze, Wiley Eastern Ltd

104216 DIGITAL ELECTRONICS

FIRST TERM:

Algebra for logic circuits: Logic variables: logic function- NOT, AND, NOR, XOR, Boolean algebra (Including Shannon's expansion theorem and consensus theorem): Canonical representations minterm, Families of logic circuits

Transistor Inverter, RTL, Diode logic, DTL, TTL brief Combinational circuits, Analysis and synthesis of Combinational circuits, Multiplexer, Encoder, Decoder, Code converter, Adder, Subtractor, comparator, Bit parity generator checker, priority encoder.

SECOND TERM:

Sequential circuits: 10 Lectures

Flip - FLOP-SR, JK, D, T

Registers- Buffer register, shift register

Counters-Asynchronous counter, Synchronous counter

Timing circuits: 5 Lectures

Digital to Analog converter (DAC) - weighted register method, R-2 R ladder method, Analog to Digital converter (ADC) parallel comparator method, counter method, successive approximation method,

Semiconductor memory:

Read only memory (ROM) - PROM, EPROM etc, Random Access memory (RAM) - static, dynamic, organisation and application.

TEXT BOOK:

Taub & Schilling: Digital Integrated Electronic (Mc Graw Hill)

REFERENCE BOOKS:

M. Morris Mano: Digital Logic and Computer Design (Prentice Hall Of India)

**ELECTRICAL ENGINEERING
THIRD YEAR**

103301 INTRODUCTIONS TO MICROPROCESSORS

FIRST TERM:

- 8085 Architecture.
 - Introduction, Pin functions, Internal Organisation.
- 8085 Programming :
 - * Introduction, Programming model, Instructional timings.
- 8085 Interrupts:
- 8085 Interfacing with memory.

SECOND TERM:

- 8085 Interfacing with I/O
 - I/O ports, Data transfer schemes, supporting chips.
- 8085 Applications: Introduction, system Design examples, Development aid.
- Introduction to 8086 Architecture, Instruction Set

TEXT BOOKS:

Introduction to Microprocessors by A.P. Mathur

REFERENCE BOOK:

Microprocessor Architecture, programming and Applications with the 8085/8080 A by R.S. Gaonkar

103302 INSTRUMENTATION- I

FIRST TERM:

- 1. System of units:** Fundamental and derived units, system International (S.I.) units Dimension.
- 2. Potentiometers:** D.C. Potentiometer, Crompton and Virnier types and their applications, self balancing (automatic) potentiometers, A.C. potentiometers, Co-ordinate and polar types and their applications.
- 3. Measuring Instruments:** Operation and construction of galvanometer, (d.c, and c.c.) Ammeters and voltmeters (Moving iron, moving coil and thermal) and wattmeter's (Dynamometer and induction types) Induction type energy meters, testing and compensation. Frequency-meters (Electrical resonance type), single phase and power factor meters, Muggers and multi meters.
- 4. Instruments transformers:** Current and potential transformers. Ratio and phase angle errors.
- 5. Measurement of resistances:** Measurement of low resistance by Kelvin double bridge and potentiometer method, Measurement of high resistance by loss of charge method.

6. High voltage measurement: Surge and impulse test and oil testing set.

SECOND TERM:

- 1. Measurement of Induction and Capacitance:** AC, bridges, Maxwell, Wien Anderson and shearing bridges General equations and vector diagram under balanced conditions, Errors and precaution in bridge measurements, Wagner's earth connection and shielding of bridge measurement, Wagner's earth connection and shielding of bridge elements.
- 2. Magnetic measurement:** Ballistic galvanometers and flux meters. Measurement of flux by Ballistic galvanometers and flux meter, Determination of B-H curve and hysteresis loop, Separation of hysteresis and eddy current losses by using Lloyd Fisher square.
- 3. Electronic instruments:** C.R.O. and its uses in measurement of frequency and phase angle, determination, B-H curve and measurement of die electric loss D.C. & A.C. voltmeters, Differential voltmeters A/D and D/A conveyors, Digital voltmeters and multi meters.
- 4. Measurement of Non-electrical Quantities:** Primary sensing elements, classification and selection of transducers.
Displacement transducers, strain gauges, Temperature transducers and photoelectric transducers, Measurement of strain, temperature and pressure

TEXT BOOKS:

1. Electrical Measurement and Measuring Instruments by Rajendra Prasad (Khanna Publisher, Delhi)
2. Electronic Instrumentation and Measurement Technique by W. D. Cooper 7 A.D. Helfrick, Prentice Hall, India.

104303 ANALOG ELECTRONICS

FIRST TERM:

Analysis single stage small-signal amplifiers, multistage amplifiers Feedback amplifiers, power amplifiers.

SECOND TERM:

Tuned amplifiers, Oscillators, operational Amplifiers, modulation and demodulation, Rectifiers and power supplier

103304 SIGNALS & SYSTEMS

FIRST TERM:

- 1. SIGNALS & THEIR REPRESENTATION:**

Basic Continuous time Signals

Basic discrete time Signals

Linear time invariant Signals

Random Signals

2. INTRODUCTION TO LINEAR SYSTEMS:

Introduction

Linear system from a physical viewpoint

Linear system from a Mathematical view point

3. FOURIER SERIES & TRANSFORMS:

Fourier series expansion

Symmetry conditions

Exponential form of Fourier series

Fourier Integral & Fourier Transform

Analysis by Fourier Methods

Gibb's Phenomena

Concept of phase & Frequency spectrum

4. LAPLACE TRANSFORMS:

Introduction

Conversion from F-transform to L-transform

L-transforms of some important functions

The shifting Theorem & its applications

The gate function

L-transform of periodic functions

L-transform of operations

5. INVERSE LAPLACE TRANSFORMATIONS:

Introductions

Heaviside's expansion Theorem

Analysis of system response

Initial & Final Value Theorem

The Convolution integral

The Super position integral

Inverse L-transformations at some irrational functions

SECOND TERM:

6. SAMPLED-DATA SYSTEMS & THE Z-TRANSFORMATIONS

Introduction

The Z-transformations
Z-transformations of some important functions
The shifting Theorem
The initial & final value Theorem
Introduction to difference equations
Solution of difference equations Pulse transfer functions.

7. MATHEMATICAL MODELLING OF PHYSICAL SYSTEMS:

System response & transfer function
Block diagram representations
Rule for block diagram transformations Signal flow graph
Mason's gain formula & its applications

STATE VARIABLE REPRESENTATION:

Concept of state, state variable & state model, Difference between state variable & phase variable, state model for linear continuous time systems, Transition and resolvent matrix, Solution of State equations, Eigen values & given vectors

9. RANDOM SIGNALS:

Introduction Properties
Correlation of signal (Auto-correlation & cross-correlation), Gaussian probability density function- Gaussian noise, white noise

10. NOISE—Introduction & type of noise

Noise figure, S/N ratio, Calculation of noise figure

BOOKS-TEXT/REFERENCE:

1. Analysis of linear systems— By D.K. Cheng.
2. Circuit & System Analysis— By A. Papoulis.
3. Signal & Linear system— By Gabel & Roberts.
4. Communication system— By Hawkins.
5. Communication system— By Kennedy.
6. Control System Engineering— By Nagrath & Gopal

103305 ELECTRICAL MACHINES - II

FIRST TERM:

Single Phase Induction Motor: Theory and operation, other single phase motors, such as Universal, repulsion, hysteresis, Reluctance motors, Stepper motor and synchros, Balanced and unbalanced operation. Two phase control motors, A.C. Tachometers, Selsyno

Electromechanical Energy Conversion Principles: Energy balance. Energy in single excited magnetic system, Mechanical forces and energy, State function, Variable co-energy, singly excited electric fields, multiple excited magnetic field systems, Dynamic equations

SECOND TERM:

Synchronous Machines: Construction and types, Windings, Generator and Motor operations, armature reaction, Phasor diagram, Salient pole machine, Two axis theory, Voltage, voltage regulation, Operation of synchronous machine on infinite bus, Parallel operation of synchronous generators, Starting and synchronization of synchronous motor, V-Curves, Torque angle characteristics and hunting

Introduction to Generalized theory of Electrical machines

TEXT BOOKS:

1. Electric Machinery— By Fitzgerald and Kingsley (Mc Graw Hill).
2. Electric Machines— By Nagrath and Kothari (Tata-Mc Graw Hill).
3. Alternating Current Machines— By M.G. Say.

103306 POWER SYSTEM - I (ELECTRICAL)

FIRST TERM:

1. **Distribution:** Effect of system voltage on transmission efficiency: single phase A.C, 3-phase A.C. System, Choice of Conductor's size, choice of voltage Radial and ring feeders: Calculation of voltage drops in A.C. radial and ring system, Hot line maintenance.
2. **Electrical Design:** Calculation of inductance of conductor due to internal and external flux: inductance of single phase system: skin and proximally effects/ G.M.R. of solid conductor, G.M.R. of stranded conductor. Mutual G.M.D. Inductance of opposite conductor lines: inductance of 3-phase lines single circuit and double circuit, symmetrical spacing and unsymmetrical spacing, inductance of bundled conductor system, Calculation of capacitance of single phase and 3-phase system, symmetrical and unsymmetrical spacing, single circuit and double circuit bundled conductor system, effect of earth on capacitance of line, Inductive interference between power and Communication lines

3. **Mechanical Design** : Types of supports, cross arms and conductors; Calculation of sag and tension, cases of unequal height of supports; stringing chart; earth clearance of live conductors, vibration; dampers. Insulators: Types, String efficiency, grading rings, arcing horns, testing of Insulators.
4. **Corona** : Calculation of voltage gradient in case of single conductors system and bundled conductor system; critical voltage; visual critical voltage; effect of temperature; atmospheric pressure; conductor's type and surface conditions etc. Power loss due to corona, Advantages of corona.

SECOND TERM:

5. **Performance of Lines:** Short medium and long lines; A.B.C.D. constants; regulations nominal and T; equivalent pi and T representation; surge impedance, loading of a line; universal power circle diagram. Lossless line, Reactive compensation of transmission lines, travelling waves, Bewley's lattice diagram. Reflection and refraction at cable junction and T junction.
6. **Problems of Long A.C. Lines:** Ferranti effect, charging current, stability etc.
7. **H.V.D.C. Transmission:** Conversion, inversion, shunt capacitors, harmonic filters, control of current during normal operation and fault condition, advantages and disadvantages of H.V.D.C. applications.
8. **Power Factor improvement:** Disadvantages of low P. f., P. f. correction at power stations, Sub-stations and industry, cost analysis of p. f; improving plants.
9. **Underground cables:** Types; Insulating materials used; stress in insulation and capacitance inters heat and capacitance grading P.F. in cables capacitance of 3-core cables, Instantaneous and long time breakdown strength dielectric losses, ionization, deterioration, heat production, sheath current, terminal characteristics.

TEXT BOOKS:

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| 1. Elements of Power System Analysis | by Stevenson (M.C. Graw Hill). |
| 2. Modern Power System | N Jagriti & Kothari—TMH: |
| 3. Electric Power System | By C.L. Wadhwa |

REFERENCE BOOKS:

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| 1. A Course in Electrical Power | by Soni, Bhatnagar & Gupta. |
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103307 ELECTROMAGNETIC FIELD THEORY

FIRST TERM:

Concept of gradient, divergence and curl, Integral theorems, Coulomb's law, Gauss Law, Equipotential surface, Divergence theorem, Poisson's and Laplace's equation, solution of boundary value problems,

evaluation of capacitance. Electrostatic energy, Electrostatic uniqueness theorem, Faraday's law, Magneto static energy, Ampere's laws, Magnetic vector and scalar potentials, Maxwell's equations, equation of continuity, Boundary conditions. Propagation of uniform plane waves, conductors and Dielectrics, Polarization.

SECOND TERM:

Reflection and refraction of plane waves, Brewster angle, surface impedance, Poynting, theorem, Power loss in a plane conductor, Transmission line equations, standing waves, Impedance matching. Transmission charts, Smith chart, Guided waves rectangular wave guides, wave impedances and characteristic impedances. Retarded potentials, Radiation from elementary dipole and half wave dipole, Radiation pattern

TEXT BOOKS:

Electromagnetic waves and Radiating Systems

By E.C. Jordan & K.G. Bamlain (Prentice Hall of India Pvt. Ltd)

105308 COMPUTERS PROGRAMMING (C LANGUAGE)

Variable names, Data types and sizes, constants, Declarations, Arithmetic Operations, Relations and Logic operators, Type conversions, Increment and decrement operators, Bitwise operators, Assignment operators and Expressions, Conditional Expressions, Procedure and order of Evaluation Statements and Blocks, Else-if with, Loops-while and For Loops-D-while, Break and continue, GOTO and Labels, Basic functions, Functions returning non-integers, External variables, Scope rules, Header Files, Static Variables, Register Variables. Block Structure, Initialization, Recursion Pointers and Addresses, Pointers and Function Arguments, Pointers and Arrays Address Arithmetic, Character Pointer and Functions, Pointer, Arrays Pointer to multidimensional, Arrays, command line Arguments, Pointers to function, Complicated declarations, Basics of structures, Structures and Functions Arrays of Structures, Pointers of structures, Self-referential structures, Table lookup, Typedef, Unions, Bit-fields, Standard input, and output Formatted Output prints, Variable-length Arguments Lists, Formatted input-Scant File Access, Line Input and output, Miscellaneous Functions.

TEXT BOOKS:

1. B.W. Kerningham & D.M. Ritchie-"The C Programming Language" Prentice Hall of India, New Delhi.
2. V. Krishnamurthy & K.R. Radhakrishnan-"Programming in C" Tata McGraw-Hill New Delhi,
(c) Comparison of alternatives and replacement studies.

104316 DIGITAL ELECTRONICS

FIRST TERM:

Algebra for logic circuits: Logic variables: logic function- NOT, AND, NOR, XOR, Boolean algebra (Including Shannon's expansion theorem and consensus theorem): Canonical representations minterm, Families of logic circuits

Transistor Inverter, RTL, Diode logic, DTL, TTL brief Combinational circuits, Analysis and synthesis of Combinational circuits, Multiplexer, Encoder, Decoder, Code converter, Adder, Subtractor, comparator, Bit parity generator checker, priority encoder.

SECOND TERM:

Sequential circuits: 10 Lectures
Flip - FLOP-SR, JK, D, T
Registers- Buffer register, shift register
Counters-Asynchronous counter, Synchronous counter

Timing circuits: 5 Lectures
Digital to Analog converter (DAC) - weighted register method, R-2 R ladder method, Analog to Digital converter (ADC) parallel comparator method, counter method, successive approximation method,
Semiconductor memory:
Read only memory (ROM) - PROM, EPROM etc, Random Access memory (RAM) - static, dynamic, organisation and application.

TEXT BOOK:

Taub & Schilling: Digital Integrated Electronic (Mc Graw Hill)

REFERENCE BOOKS:

M. Morris Mano: Digital Logic and Computer Design (Prentice Hall Of India)

105310 PROGRAMMING METHODOLOGY AND DATA STRUCTURE

FIRST TERM:

Problem Analysis Algorithm and Flow chart specification, Introduction to PASCAL: Constants, variables, Expression, Logical operations and expressions, Looping and branching, statements, iteration and recursion, program, procedure and function structure, Array, record and pointer, file processing.

SECOND TERM:

Elementary Motions of analysis of algorithm - time space trade off, Sorting and Searching algorithms.

Data Structures

Arrays and ordered list

Stack and Queue

Linked list

Tree

TEXT BOOKS:

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| 1. Fundamental of data structure | By Horwiley & Sahni |
| 2. Computer Algorithm | by Horwiley & Sahni |
| 3. PASCAL | by Wirth |

103311 AUTOMATIC CONTROL SYSTEMS

FIRST TERM:

1. Introduction and type of feedback control system.
2. Mathematical modeling of physical system, linearization of non-linear system, transportation lag.
3. Time domain analysis of control system.
4. Root locus techniques
5. Frequency domain analysis of control system.

SECOND TERM:

1. Time domain design of control system.
2. Frequency domain design of control system.
3. Controllers and their tuning.
4. Performance index and error criterion.

TEXT BOOKS:

1. Control Systems Engineering by Nagrath, Gopal
2. Automatic Control System by Hasan Sayeed
3. Linear Control System by B.S. Manke
4. Automatic Control System by Prof. Kuo

104312 DIGITAL SIGNAL PROCESSING

FIRST TERM:

Discrete time signals and systems, stability and causality of linear shift invariant system, Z-transform, Flow - graph and representation of digital filters, Effect of quantization of parameters, Digital filter design.

SECOND TERM:

Design based on analog filters, input invariance and bilinear transformation approach, computer aided design, computation of DFT and FFT algorithm, Effect of finite register length in digital signal processing.

TEXT BOOKS:

Digital Signal Processing by Allan V. Oppenheim and Ronald W. Shafer Prentice Hall of India

103313 CONTROL SYSTEM DESIGN

FIRST TERM:

1. Introduction, design specifications, controller configurations, fundamental principles of design, design with PD controller, time domain interpretation of PD control, frequency domain interpretation of PD controller, summary of effects of PD control, design with PI controller, time domain interpretation of PI control, frequency domain interpretation of PI controller, summary of effects of PI control.
2. **DESIGN WITH PID CONTROLLER**
Design with phase lag controller- time domain interpretation of phase lag control, frequency domain interpretation of phase lag controller, time-domain interpretation of phase lead control, design with phase lead controller, summary effects of phase lead control,, multistage phase lead controller, design with lag-lead controller, pole zero cancellation design, notch filter, forward and feed forward controllers, design of robust control system, minor loop feedback control systems.

SECOND TERM:

1. **HARDWARE AND SOFTWARE IMPLEMENTATION OF COMMON COMPENSATOR:** Physical realization of common compensators with active and elements, tunable PID algorithms- position and velocity algorithms, Ziegler-Nicholas method for controller tuning.
State feedback control, pole placement design through state feedback, state feedback with integral control, design of state observer
2. **DESIGN OF DISCRETE DATA CONTROL SYSTEMS:** Introduction, digital implementation of analog controller, PID and lead-lag controllers, digital controllers, design of discrete data control system in frequency domain and Z-plane. Synthesis through pole zero configuration, determination of closed loop system functions from the specifications, determination of open loop transfer function from the closed loop transfer function, additional correlation between open loop and closed loop characteristics.

TEXT BOOKS:

1. Automatic Control System by B.C Kuo
2. Control Systems Principles and Design by M. Gopal
3. Discrete Time Control Systems by K. Ogata

REFERENCE BOOKS:

1. Digital Control and State Variable Method by M. Gopal, TMH

ELECTRICAL ENGINEERING
FOURTH YEAR
102405 ENGINEERING ECONOMICS AND MANAGEMENT

FIRST TERM:

- 1. Engineering economy:** (a) Simple and compound interest, Annuities (b) Depreciation, Causes Methods, (c) Comparison of alternative and replacement studies, (i) Equivalent annual cost method, (ii) Present worth method, (iii) Rate of return method. 5 Lectures
- 2. Accounting:** (a) Double entry book keeping, (b) Journal (c) Ledgers, (d) Manufacturing Account: Profit and loss accounts, (e) Balance sheet. 7 Lectures
- 3. Costing:** (a) Cost and cost accounting elements of costs, (b) Break Even analysis determination selling price and profitability, (c) Overhead cost allocation, (d) Costing system. Job costing, unit costing, process costing, operating cost, departmental cost, (c) Cost control: Actual and standard cost, Budget and budgetary control. 7 Lectures
- 4. Entrepreneurship development:** (a) Introduction to Entrepreneurship (b) Motivation (c) Psychological factors. Risk taking behaviour, (d) Rural Entrepreneurship (e) Self employment.

SECOND TERM:

- 1. Management and organisation:** (a) Principle of management (c) Elements of management, planning, organising, direction and control, (c) Organisation structure and charts. Line, staff functional and committee organisation. 4 Lectures
- 2. Industrial management: Industrial ownership:** Proprietorship Joint Stock Company and cooperative societies, (b) Site selection, (c) Plant layout: Press oriented, product orient Layouts, line balancing. 4 Lectures
- 3. Production Materials Management:** (a) Production type, job order, balanced mass production, (b) Inspection and quality control, (c) Inventory control, economic order quantity. 4 Lectures
- 4. Optimization techniques:** (a) Linear programming: Graphical method, Analytical method of solution, (two variables) (b) CPM and PERT. 4 Lectures
- 5. Personal Management:** (a) Functions: recruitment, selection Training, promotion, discipline, welfare, (b) Job evaluation, (c) Merit Rating, (d) Wages and incentives. 4 Lectures
- 6. Marketing Management:** (a) Market research and sales force-casting, (b) Sales managements (c) Advertisement and sales promotion 4 Lectures

BOOKS RECOMMENDED:

1. **Engineering Economy:** By Carmo, Sallion and Canada (MacMillan) Publ. Co. New York, and Collier MacMillan Publishers, London.
2. **Industrial Organisation and management:** by Bethal, Atwater, Smith and Stackman (McGraw Hill Book Co.)
3. **Industrial Organisation and Engg. Economics :** by Banga and Sharma (Khanna Publishers Delhi)
4. **Industrial Accounting:** by O.P Khanna Dhanpat Rai and Sons, Delhi.
5. **Management Accounting:** by Anthony Robert N.
6. **Development of Entrepreneurship:** by Undai Pareek and T. Vankateshwara Rao (Sanjiv Pritery, Ahmedabad).

103402 POWER ELECTRONICS

FIRST TERM:

Power diodes, power transmitter, Thyristors G.T.O, Their characteristics, rating, protection and cooling, Series and Parallel operation, firing and typical control circuits

Phase controlled converter: 1. Phase. 3-phase and polyphase, semi/Full, circuits with free-wheeling diode, Analysis and performance

Application: D.C. Motor control, Speed control of slip-ring I/M OPS.

SECOND TERM:

Voltage Controllers: 1- Phase/3 Phase, typical control for integral cycle control/phase control, application such as heater control, light dimmer.

Forced Commuted Convertors: Forced commutation circuits, Introduction to DC/DC Choppers, Classification control Sintegies, Multi-phase choppers, Application of Choppers for DC motor control.

DC/AC Inverters: Classification, Configuration, And 1-phase/3-phase, VSI, PWN, And CSI: Frequency and voltage control, typical circuits, High frequency inverters, Application to AC motor control, UPS Induction heating.

TEXT BOOKS:

1. Thyristors and power Controllers Dubey, Daradia, Joshi, Sinha, Wiley Eastern.
2. Power Electronics and controls, Samir K. Data, Prentice-Hall of India.

REFERENCES:

Thyristors and their application, M. Ramamurthy

Power Electronics, D.A. Bradley, V.N.R. (U.K.) Co. Ltd

103403 INSTRUMENTATION – II

FIRST TERM:

1. **Errors in measurements:** Classifications of errors, statistical analysis of errors, probable error and limiting errors, calculation of limiting errors.
2. **Power system measurements:** Measurements of zero, possible and negative sequence current and voltage. Measurement of cable faults and earth resistance.
3. **Electronic Instruments:** Special purpose CROS (Dual trace, Dual beam, storage and digital CROS Vector voltmeter, frequency meter. Universal counter and its uses for measurement of frequency, time, pulse width.
4. **Measurement of non electrical quantities:** Piezoelectric transducer, Digital displacement transducer (small angle encoder) Measurement of velocity, acceleration force flow of liquids, liquid levels, Digital temperature measurement.

SECOND TERM:

1. **Wave analysis:** Wave analyzer, frequency- selective wave analyzer and heterodyne wave analyzer distortion measurement, Resonant circuit harmonic analyzer, heterodyne harmonic analyzer and fundamental suppression, harmonic analyzer, spectrum analyzer.
2. **Display and receiving system:** Digital display, LED, LCD, strip chart recorder, X-Y recorder and tape recorder.
3. **Data acquisition system:** Signal condition, sample and hold circuits and multiplexing, telemetry, D.C. telemetry, positive telemetry, A.C. telemetry, pulse telemetry and radio telemetry, modulation, amplitude, frequency and pulse modulation, signal filtering, signal averaging, signal correction and signal coding, data processing.
4. **Power Measurement at high frequency:** Thermocouple power meter, Bolt meter method, calorimeter method, directional couplers.

TEXT BOOKS:

1. Thyristors and Power controllers by Dubey, Daradia, Joshi, Sinha, Wiley Eastern.
2. Power Electronics and Controls by Samir K Datta, Prentice Hall of India.

REFERENCES:

1. Thyristors and their application by M. Ramamurthy
2. Power Electronics by D.A. Bradely, V.N.R. (U.K) Co. Ltd.

103404 PROTECTIONS OF POWER APPARATUS AND SYSTEMS

FIRST TERM:

1. **Basic Principles and Components of Protection:** Basic ideas, Nature and causes of faults and fault statistics; Zones of protection; Primary and backup protection. Methods of discrimination; Pick up and reset values; Holding coil and seal in relay; Circuit quantity from three phase; Components of protection.
2. **Constructional Features:** Types of electromagnetic relays. Theory of induction relay torques; Directional and non-directional units; Thermal relays; Operating Principles, General equation for electromagnetic relay, over current relay-inverse characteristics and definite time characterizations; time setting and current setting.

parallel feeders; Distance protection; Impedance; modified impedance; reactance and MHO type relays-their construction connection, operating principles characteristics on R-X diagrams, Effect of arc resistances and power surges on distance relays, selection of distance relays for short medium and long lines for ground and phase faults, introduction to differential protection, and Buchholz's relays, protection of alternators, Generator protection against short-circuits and earth faults, protection of bus-Bars and motors.
4. **Auto Reclosing:** Introduction, three phases versus single phase auto reclose.
5. **Static Relays and Comparators:** Basic for static relay, Amplitude comparators, phase comparators, phase comparator.

SECOND TERM:

6. **Circuit Breakers:** Theory of circuit interruption: Introduction, Physics are Phenomena, maintenance of the arc Losses from plasma, Essential properties of arc, Arc suppression theories.

Circuit constants relation to circuit breaking, Circuit constants and circuit conditions, Restricting voltage, transient characteristics, of restricting voltages current chopping, duties of switch gear, Air break CB, Oil CB SF6 circuit breakers, Air blast CB; and vacuum circuit breakers.

Comparative merits of different types of conventional CB; Testing of CB, Introduction; simple testing Station; Equipment used in the Station; Testing procedure, Direct testing; Indirect testing.
7. **Protection of Lines from over voltage:** Lightening phenomenon ground wires, surge diverters, surge absorbers arcing ground, Peterson's coil wave shape of surge produced in laboratory, impulse ratio, B, I.L and insulation co-ordination, carrier current protection.

8. **Earthing:** Safety and system earthing, Electrodes-wires, rods and mesh type, solid neutral grounding Neutral grounding through resistance and transformer counter poises.
9. Introduction to Microprocessors and its uses in the field of protection.

TEXT BOOKS:

1. B. Ram and D.N. Vishwakarma, "Power system protection and switch gear" TMH
2. Ravindra Nath and M. Chander " Power System Protection and switch gear" Wiley Eastern

REFERENCE BOOKS:

1. Warrington "Protective Relays- their theory and practice" Chapman and Hall

103405 POWER SYSTEM - II

FIRST TERM:

1. **Power stations and sub-stations:** Hydro Power Station: Site selection, layout, calculation of available power, classification, salient feature, pumped hydro plants.

Thermal Power Station: Site selection layout, calculation of coal requirements, cooling water, efficiency, co-ordination of hydro and thermal power station/ Diesel and Gas Turbine Stations; Advantages as stand by generation : Construction Principle and application, Bus bar arrangements, size of generating units, choice of generating voltage, Indoor and outdoor sub-stations.

2. **Economy of Power System :** Load curves, Load duration curves, diversity factor, Load factor, demand factor and plant use factor, base and peak Loads, base and peak load stations, cost allocation of power station-fixed cost, operating cost, two part tariff and its evaluation.

Incremental fuel rate, incremental production cost, optimum scheduling of generating units and plants.

3. **Power Grid:** Its advantage.
4. **Systematical three phase faults on synchronous machines:** Short circuit currents and reactance's of synchronous machines, Internal Voltage of loaded machine under transient conditions.

SECOND TERM:

5. **Symmetrical Components:** Synthesis of unsymmetrical phase from their symmetrical components, operators. The symmetrical components of unsymmetrical phase, phase shift in transformer banks; power in terms of symmetrical components; unsymmetrical series impedances; sequence

- impedances and sequence networks; sequence networks of unbalanced generators; Sequence impedance of circuit elements positive and negative sequence networks; zero sequence network.
6. **Unsymmetrical Faults:** Single line to ground, line to line fault: and double line to ground fault on unloaded generator and power systems, Interpretation of intersequence networks.
 7. **Power system Stability:** Steady state power limit of cylindrical rotor and salient pole machines without saturation Maximum power transmitted to a transmitting network, series capacitor. Transient stability power angle curve, Inertia constant, equal area criteria and its application critical angle.
 8. **Load Flow Analysis:** System model-static load flow equations and their characteristics: classification of system variables solution of static load flow equations, bus classification; Computational aspect of load flow problems; Interactive computation of the load flow equations, Gauss-Seidel method; flow diagrams for the computation of static load flow equations.
 9. **Load Frequency Control:** Control system structure, PI versus PV control; Mathematical model of speed governing system; Definition of control area, Incremental power balance of control area, Pf control of single control area the uncontrolled and controlled cases.

TEXT BOOKS:

1. Elements of Power System Analysis. 3rd Ed-Stevenson (Mc Graw Hill).
2. Electric Energy System theory— Elgerd (Tata Mc Graw Hill)
3. A course of Electrical Power— Soni, Bhatnagar & Gupta (Dhanpat Rai & Sons)
4. Power plant Engineering—Nagpal

103406 AUTOMATIC CONTROL SYSTEMS

FIRST TERM:

1. Introduction and Type of feedback control system.
2. Mathematical modeling of physical system, linearization of non-linear system, Transportation lag.
3. Time domain analysis of control system.
4. Root-Locus techniques.
5. Frequency domain analysis of Control System.

SECOND TERM:

6. Time domain design of control system.
7. Frequency domain design of control system.

8. Controllers and their tuning.
9. Performance Index and Error criterion.

TEXT BOOKS:

1. Control systems Engineering— Nagrath, Gopal.
2. Automatic control system— Kuo.

104407 COMMUNICATION SYSTEMS

FIRST TERM:

- Review of signals and systems. Fourier Transforms.
- Introduction to communication system,
- Generation & Demodulation of AM signals including DSB-SC. SLB-VRB.
- Frequency Division Multiplexing (FDM)
- Super-heterodyne & Communication receivers.
- Generation & Demodulation of FM/PM signals.
- Noise in AM/FM system (briefly)

SECOND TERM:

- Pulse Modulation system, sampling theory.
- Generation & demodulation of PAM, PVVM & PPM
- Time division multiplexing (TDM)
- Antenna, transmission line & wave propagation (a introduction)
- Applications: (System description in brief)
 - AM/FM Radio Broadcasting & reception system
 - TV Broadcasting & reception system including colour TV
 - Line Communication (Telegraphy)
 - Telephony system including PBX & electronic exchanges
 - Microwave communication links
 - Satellite communication system
 - Radar, Navigation & Civil aviation communication systems
 - Power on line carrier communication system

103408 ADVANCE MICROPROCESSOR

FIRST TERM:

8086 Architecture, 8086 programming, 8086 interfacing with memory and peripherals, introduction to 186/286/386/486 (with emphasis on feature)

SECOND TERM:

Bit sliced microprocessor, RISC processor, trouble shooting and development aids, application of microprocessors

TEXT:

1. Microprocessor: Comprehensive studies by Naresh Grover
2. Introduction to microprocessors by A.G. Mathur
3. Introduction to microprocessors by B. Ram

103409 UTILIZATION AND TRACTION

FIRST TERM:

- 1. Industrial Drives:** Characteristics of electrical motors and their particular application for Industrial drives, motor enclosures, bearing, transmission of drive, choice of motors, motors used for Jiffs, cranes and general purpose machines.

Typical applications in sugar, textile, paper and steel industries, motors used in mining operations

Rating of electric motors, calculation of size load equation by Fly Wheels

Electric Braking: Plugging dynamic and regenerative braking, braking current torque, speed time curves (number of revolutions made before stop).

- 2. Traction:**

Electric traction, general features, traction motors and their characteristics controller and auxiliary equipment, system of railway electrification, trade remittance traction effort, speed time curves, energy consumption, modern trends in electrical trades.

SECOND TERM:

- 1. Heating and Welding:** Electric heating, resistance
- 2. Illumination:**
- 3.** Electrolytic process and motor control circuit.

BOOKS:

1. Utilization of Electrical energy by E. Openshaw Taylor
2. Utilization of Electrical energy by R.K. Garg
3. Electric Traction by Dover
4. Advanced Microprocessor

105410 COMPUTER ORGANIZATIONS

FIRST TERM:

Introduction to Computer organization

History of computer development, the 1st, 2nd, 3rd, and 4th generation computer and their characteristics

Processor design

Processor organization, information types and their representation error detection and correction, types, format and addressing modes of modern digital computers and their effect on speed and performance.

Fixed point arithmetic, ALU design, bit sliced, ALU

Instruction sequencing and interpret User

Hardware control: design methods, multiplier control, CPU control unit

SECOND TERM:

Micro program control: CPU control unit, multiplier control unit, nonprogramming

Memory

Memory device characteristics, RAM, flip-flops and charge storage devices, 1D and 2D organization ferrite core, serial access memories, magnetic disk, magnetic bubble, CCD memories.

Virtual memory: memory hierarchies and design objective, address mapping, relocation, main memory allocation, segments and pages, Input/Output

I/O devices: punched tape/cards, keyboard, terminals, printers, CRI, I/O bus, programming and interrupt I/O processors, case study.

TEXT BOOKS:

1. Computer Architecture and organization by J.P. Hayes
2. Digital Computer Fundamentals by T.C. Bartee

103411 MODERN CONTROL THEORY

FIRST TERM:

Development of state space modes-state and state equation, transfer function from state equation, state equation from transfer function, state transition matrix, solution of state equation, transfer matrix, concept of controllability and absorbability, state variable feedback, asymptotic state observers, control system design via pole placement

SECOND TERM:

Optimal control systems, introduction- performance indices, transfer functions approach, state variable approach, parameter optimization.

Non-linear systems, common non-linearity, stability of non-linear systems, methods for studying non-linear systems, methods for studying non-linear systems

Linearization: Describing function analysis, the phase plane method, stability analysis using Lyaprov's direct method

TEXT BOOKS:

1. Modern control system by I.J. Nagrath and Gopal
2. Automatic control system by Kuo

104412 DIGITAL COMMUNICATIONS

FIRST TERM:

Introduction to telecommunication, power spectral density of digital modulation, scalar and vector communication over discrete memory less channel, coherent communication with wave forms, non-coherent communication with wave form, partially coherent communication with wave form.

SECOND TERM:

Differentially coherent communication with wave form, double differentially coherent communication with wave form, communication over band limited channel, demodulation and detection of other digital modulation, coded digital communication, black coded digital communication, convolution coded digital communication.

TEXT BOOK:

1. Digital Communication Techniques: Signal Design and Detection by Marvin Simon and Sami Hindi, Prentice Hall