1st Semester

MTH 504 ADVANCED MATHEMATICS

Solution of Partial differential Equations :
Application to Boundary Value Problems. Laplace and wave Equations and electrical engineering applications to boundary value problems.

Solution of non-linear equations by Newton's, Kizner's method, Jacobi's and Gauss-SEIDEL iteration methods. Lagrange's & Hermite interpolation, picewise interpolation, cubic splines, Two-point boundary value problems by numerical techniques for linear ODE.

Cauchy's residue theorem, evaluation of integrals by various contours, conformal mapping, Schwartz christofel transformation.

Linear Programming : LPP formulation, simplex methods-phase I, phase II, Big M method, Cuality of LPP.

Non Linear Programming : Unconstrained and constrained extremal problems, and their algorithms.

Dynamic Programming : Bellman's Principle of Optimality, Dynamic Programming Approach optimal subdivision problem, Decomposition Applications to linear programming DPP algorithms.

Reference Books :

1. Higher Engineering Mathematics by B.S.Grewal
2. Operations Research by Kanti Swaroop, P.K.Gupta and Man Mohan
3. Operations Research – Algorithmic Approach – Gillettee

ED 501: POWER CONTROLLER

INTRODUCTION :

Various power semiconductor devices i.e. SCR, GTO, MOSFET, BJT, IGBT & MCT's & their protection, series-parallel operation, Heat sink calculations, Design of firing circuit for converters, choppers & inverters.

PHASE CONTROLLED CONVERTERS :

Analysis & design of 1-ϕ bridge converter, 3-ϕ bridge converter with and without freewheeling diode, effect of source impedence, power factor improvement techniques, pulse width modulated converters, Dual converters, converter for HVDC application & DC drives.

CHOPPERS :

Analysis & design of voltage commutated, current commutated and load commutated choppers, multiquadrant choppers, chopper for traction application. Resonant choppers, SMPS.

INVERTERS :

Detailed analysis of 1-ϕ VSI, 3-ϕ VSI (180° mode, 150° mode & 120° mode of conduction), various inverter commutation circuits, harmonic reduction techniques, PWM inverters, Inverters for HVDC application & AC drives.

Advantages & limitation of current source inverters over VSI, 1-ö and 3-ö CSI. Resonant inverters.

CYCLOCONVERTERS :

1-ϕ to 1-ϕ, 3-ϕ to 3-ϕ cycloconverter circuits, circulating current scheme, non-circulating current operation, Mean output voltage, harmonics in supply current waveform & input-power factor. Concept of power quality

Reference Books :

1. Thyristorised Power Controllers - G.K.Dubey, Doradla, Joshi, Sinha
2. Power Electronics - C.W.Lander
3. Power Electronics - Rashid
4. Thyristorised power controlled converters & cycloconverters - B.R.Pelly
5. Power Electronics - N.Mohan
6. Power Electronics Application - Vithyathil.
7. Power Electronics – Philip Kranes

ED 502 : ELECTRICAL DRIVES I

Electrical Drives Introduction, Choice of Electrical Drives, Dynamics of Electrical Drives, Concept of Multiquadrant operation, Components of load torques. Selection of motor power rating.

D.C.Drive, speed torque, speed control. Starting, Breaking. Controlled rectified fed DC drive, chopper controlled dc drives.
Close loop control of d.c. drive. Transient analysis.

Induction Motor Drives : Three phase I.M., analysis and performance. Operation with unbalanced source voltages and single phasing, analysis of I.M. fed from Non-sinusoidal voltage supply. Starting, Braking, Transient analysis.

Speed control methods of IM, v/f controlled induction motors, controlled current and controlled slip operation, PWM inverter drives, Multi-quadrant drives and field oriented control, slip power control, mathematical modeling of induction motor drives, transient response and stability analysis, single phase I.M. Close loop control of I.M. Drives.

Synchronous Motor Drives, cylindrical rotor wound field motor, salient pole wound field motor, synchronous reluctance motor, Hysteresis synchronous motor, operation from fixed frequency supply, starting, braking, synchronous motor variable speed drives, starting large synchronous machines.

Reference Books :

1. Power semi conductor controlled drives by G.K.Dubey
2. Fundamentals of Electrical Drives by G.K.Dubey
3. Electrical Machine & Power Electronics by P.C.Sen
4. Electrical Drives by S.A. Nasar

ED 503 : MODELLING AND ANALYSIS OF ELECTRICAL MACHINES

Review : Primitive machine, voltage and torque equation.
Concept of transformation change of variables & m/c variables and transform variables. Application to D.C. machine for steady state and transient analysis, and equation of cross field commutator machine.

Induction Machine : Voltage, torque equation for steady state operation, Equivalent circuit, Dynamic performance during sudden changes in load torque and three phase fault at the machine terminals. Voltage & torque equation for steady state operation of 1-ö induction motor & scharge motor.

Synchronous Machine : Transformation equations for rotating three phase windings, Voltage and power equation for salient and non salient alternator, their phasor diagrams, Simplified equations of a synchronous machine with two damper coils.

Operational Impedances and Time Constants of Synchronous Machines : Park's equations in operational form, operational impedances and G(P) for a synchronous machine with four Rotor Windings, Standard synchronous machine Reactances, time constants, Derived synchronous machine time constants, parameters from short circuit characteristics.

Approximate Methods for Generator & System Analysis : The problem of power system analysis, Equivalent circuit & vector diagrams for approximate calculations, Analysis of line to line short circuit, Application of approximate method to power system analysis.

Reference Books:
1. Analysis of Electric Machinery - P.C.Krause
2. The General theory of Electrical Machines - B.Adkins
3. The General theory of AC Machines - B.Adkins & R.G.Harley
4. Generalised theory of Electrical m/c - P.S.Bhimbra
5. Electro Mechanical Energy Conversion - White & Woodson

ED-511 ELECTIVE I
MICROCOMPUTER AND IT'S APPLICATIONS

Programmable Peripheral Devices
PPT 8255, various operating modes, fixing diagram, PIT 8253, programming and modes of operation, PIC 8259, operating modes.

Interfacing - Interfacing of peripherals, A/D & D/A converters, 8255, 8253, 8259 with 8/16 bit microprocessor/Data Acquisition system.

Microcontroller - 8051 Architecture, Counter/Timers, Instructions, Programming, Interfacing, Applications, Comparison of 8085, 8086, 8057 etc.

Programmable logic controller
PLC Architecture, programming, Counter/Timers and its applications.

References :

1. Microprocessor Architecture programming & applications – Gaonkar
2. Microprocessors & interfacing – D.V.Hall
3. The 8051 Microcontroller – K.J.Ayala
4. Introduction to programmable logic controller – Gary Dunning

ED-512 ELECTIVE I
DSP & IT'S APPLICATIONS

Introduction to DSP - Classification of signals, Multichannel and multi dimensional continuous v/s discrete time signals, continuous v/s discrete valued signals, continuous time sinusoidal signal, discrete time sinusoidal signals, sampling of analog signal, sampling theorem, quantification and coding of D/A conversion.

Discrete Time Signal and Systems - Discrete time signal, systems, Z-transform & Inverse Z-transform, analysis of discrete time, linear time invariant systems, co-relation of discrete time systems.

Frequency Analysis Of Signals - Frequency analysis of analog signals, frequency analysis of discrete time signals. Properties of Fourier Transform, Frequency Domain Characteristics, Time Frequency Dualities, Sampling of signals in time and frequency domain, DFT & FFT.

Design Of Digital Filter - Design of linear phase FIR filter using window & frequency sampling method. Design of equiripple linear phase filters. Comparision of design methods for linear phase FIR filters. Design of IIR filters from analog filters. Direct Design Technique for digital IIR filters.

DSP Application - Introduction to digital signal processors chips, case study of different DSP applications. Application of filters to analog & digital signal processor, FET spectrum analyzer.

Reference Books :

1. Digital Signal Processing - W.D.Stanley
2. Analog & Digital Signal Processing – Ashok Ambardar
3. Digital Signal Processing – S. Mitra

ED 541 LAB - I
MACHINES & DRIVES LAB

List of Experiments:

1. Study of Generalized Converter.
   (a) Record the waveforms at various points of the firing circuit for 1-phase HW & bridge, 3-phase half wave & fully controlled bridge converters.
   (b) Record the output voltage, output current, voltage across one thyristors, input current, with R & R-L load
   (c) Study the effect of load/source inductance and free wheeling diode.
   (d) Study the harmonic spectrum of input current.

2. Study the speed control of single-phase converter fed DC motor.
   (a) Record the output voltage and input/output current waveforms in open loop speed control in continuous and discontinuous mode of operation.
   (b) Study the harmonics spectrum of input current.
   (c) Perform the load test.

3. Study of single-phase AC regulator
   (a) Record the waveform at various points of the firing circuit.
   (b) Record the output voltage, input/output current, voltage across thyristors with (i) Resistive load, and (ii) Inductive load (iii) Fan load.
   (c) Study the harmonics spectrum of input current.

4. Study the v/f speed control method of the three-phase Induction Motor.
   (a) Record the output voltage and line current waveforms.
   (b) Measure the speed, terminal voltage and line current at various frequencies.
   (c) Study the harmonics spectrum of input current.

5. Study of speed control of separately excited chopper fed DC drive.
   (a) Record the waveforms at various points of firing circuit.
   (b) Study voltage and current commutation circuit.
   (c) Record the output voltage, input/output current waveforms with (i) R-Load (ii) R-L load, and (iii) Motor load.

6. (a) Perform dynamic braking and plugging on DC shunt motor and record time taken by the motor to come to rest at different external resistance settings.
   (b) Perform dynamic braking on three-phase I.M. and record the time taken by the motor to come to rest at different DC current.

7. (a) Study the speed control of 3-phase I.M. using the concept of Kramer control.
   (b) Plot the speed of the motor v/s field current of DC motor.
   (c) Record the various waveforms**.**