MAHAKAUSHAL UNIVERSITY JABALPUR

ADVANCED MATHEMATICS

UNIT- I **Marks : 14**

Solution of Partial Differential Equation (PDE) by separation of variable method, numerical solution of PDE (Laplace, Poisson's, Parabola) using finite difference methods, Elementary properties of FT, DFT, WFT, Wavelet transform, Haar transform.

UNIT- II **Marks : 14**

Probability, compound probability and discrete random variable. Binomial, Normal and Poisson's distributions, Sampling distribution, elementary concept of estimation and theory of hypothesis, recurred relations.

.UNIT- III **Marks : 14**

Stochastic process, Markov process transition probability transition probability matrix, just and higher order Markov process, Markov chain. Queuing system, transient and steady state, traffic intensity, distribution queuing system, concepts of queuing models (M/M/1: Infinity/ Infinity/ FC FS), (M/M/1: N/ Infinity/ FC FS), (M/M/S: Infinity/ Infinity/ FC FS)

UNIT- IV **Marks : 14**

Operations of fuzzy sets, fuzzy arithmetic & relations, fuzzy relation equations, fuzzy logics. MATLAB introduction, programming in MATLAB scripts, functions and their application.

UNIT- V **Marks : 14**

Introduction and definition of reliability, derivation of reliability functions, Failure rate, Hazard rate, mean time t future & their relations, concepts of fault tolerant analysis, Elementary idea about decision theory and goal programming.

Reference Books

1. Numerical Solution of Differential Equation by M. K. Jain
2. Numerical Mathematical Analysis By James B. Scarborogh
3. Fourier Transforms by J. N. Sheddon
4. Fuzzy Logic in Engineering by T. J. Ross
5. Fuzzy Sets Theory & its Applications by H. J. Zimmersoms
6. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Hill.
7. Advance Engineering Mathematics by Ervin Kreszig, Wiley Easten Edd.
8. Applied Numerical Methods with MATLAB by Steven C Chapra, TMH.
9. Introductory Methods of Numerical Analysis by S.S. Shastry,
10. Introduction of Numerical Analysis by Forberg

MAHAKAUSHAL UNIVERSITY JABALPUR

POWER SYSTEM DYNAMICS AND CONTROL

UNIT- I **Marks : 14**

INTRODUCTION TO POWER SYSTEM STABILITY PROBLEM: Basic concepts and definitions: Rotor angle stability, voltage stability and voltage collapse, Midterm and long-term stability, Classification of stability, states of operation and system security system dynamic problems.

UNIT- II **Marks : 14**

REVIEW OF CLASSICAL METHOD: System model, some mathematical analysis of steady state stability, analysis of transient stability, simplified representation of excitation control.

UNIT- III **Marks : 14**

MODELING OF SYNCHRONOUS MACHINE: Introduction, synchronous machine, parks transformation, analysis of steady state performance per unit equivalent circuits of synchronous machine, determination of parameters of equivalent circuits, measurements for obtaining data, saturation models, transient analysis of a synchronous machine.

UNIT- IV **Marks : 14**

EXCITATION AND PRIME MOVER CONTROLLERS: Excitation system Modeling, system representation by state evasions, prime move control systems. APPLICATION OF POWER SYSTEM STABILIZERS: Basic concepts, control signals, structure and tuning of PSS, field implementation and operating experience 8 Hours

UNIT – V **Marks:14**

TRNMISSION LINE, SVC AND LOADS: D-Q transformation using L-B variables, static var compensators, loads Dynamics of a synchronous generator connected to estimate bus: System model, synchronous machine model, calculation of initial conditions, inclusion of SVC Model, Analysis of single machine system, Small signal analysis with block diagram representation, synchronizing and damping torque analysis, small signal model, nonlinear oscillators.

Reference Books

1. P. W. Sauer & M A Pai: Power system dynamics and stability: Pearson Power
2. K.R. Padiyar, Power system dynamics, stability and control, BS Pub. Hydbd
3. P Kunder, Power system stability and control, TMH

MAHAKAUSHAL UNIVERSITY JABALPUR

ADVANCED POWER SYSTEM PROTECTION RELAYS

UNIT- I **Marks : 14**

Protective Relays: Relaying review, characteristics and operating equations of relays. CT's and PT's differential relay, over-current relay, reverse power relay, distance relays, applications of relays.

UNIT- II **Marks : 14**

STATIC RELAYS: Introduction, advantages and disadvantages, classification logic ckts, smoothing circuits, voltage regulator square wave generator, time delay ckts level detectors, summation device, sampling circuit, zero crossing detector, output devices. COMPARATORS: Replica Impedance, mixing transformers, general equation of phase and amplitude comparator, realization of ohm, impedance and off set impedance characteristics, duality principle, static amplitude comparators, coincidence circuit, Hall effect devices, Magneto receptivity, zener diode phase comparator multi input comparators.

UNIT- III **Marks : 14**

Generator and transformer protection: Protective devices for system. Protective devices for stator, rotor, and prime mover of generator, percentage differential relays protection, three winding transformer protection, earth fault protection, generator transformer unit protection.

UNIT- IV **Marks : 14**

Bus bar and transmission line protection: Distance protective schemes, directional wave detection relay. Phase compensation carrier protection. High impedance differential scheme, supervisory and check relay, Some features of 500 KV relaying protection.

UNIT –V **Marks:14**

Modern trends in power system protection: Different types of digital and computer aided relays, Microproecssor based relays, auto-reclosing, frequency relays, under and over frequency relays, di/dt relays. Algorithms for transmission line, transformer & bus bar protection; out-of-step relaying Introduction to adaptive relaying & wide area measurements

Member Board of Studies

Reference Books

1. Power System Protection and Switchgear, B.Ram – Tata Mc-Graw Hill Pub.
2. Switchgear and Protection, M.V.Deshpande - Tata Mc-Graw Hill Pub.
3. Power System Protection & Switchgear, Ravindra Nath, M.Chander, Willy P
4. Computer Relaying for power system, Arun Phadke, James Thorp, Johns W P
   Power System Protection, M.A.Date, Bharti Prakashan, Vallabh Vidya N,(Guj).

MAHAKAUSHAL UNIVERSITY JABALPUR

POWER ELECTRONICS APPLICATION IN POWER SYSTEM

UNIT- I **Marks : 14**

Power System components models formation of bus admittance matrix, algorithm for formation of bus impedance matrix. Reactive power capability of an alternator, transmission line model & loadability, Reactive power transmission & associated difficulties, Regulated shunt compensation, Models of OLTC & Phase shifting transformer, load flow study

UNIT- II **Marks : 14**

Sensitivity analysis: Generation shift distribution factors, line outage distribution factors, Compensated shift factors. Power systems security levels, contingency selection & evaluation, security constrained economic dispatch. Pre-contingency corrective rescheduling.

UNIT- III **Marks : 14**

Voltage stability: Proximity indicators e.g. slope of PV curve, Minimum Eigen value of reduced load flow Jacobian participation factors based on modal analysis and application

UNIT- IV **Marks : 14**

Flexible ac transmission system, reactive power control, brief description and definition of FACT's controllers, shunt compensators, configuration and operating characteristics of TCR, FC-TCR, TSC, Comparisons of SVCs.

UNIT- V **Marks : 14**

Thy thyristor controlled series capacitor (TCSC) Advantages of the TCSC, Basic principle and different mode of operation, analysis variable reactance model and transient stability model of TCSC.

Reference Books

1. Modern power system analysis D.P. Kothari, I.J. Nagrath, TMH, 2003
2. Power generation operation and control, A.J. Wood, B.F Woolenberg, John W
3. Understanding facts: Concepts and technologies of flexible AC transmission system IEEE Press, 2001 N.G. Hingorani, L. Gyugyi
4. Power system stability and control IEEE press P. Kundur, 1994
5. Thyristor Based FACTS controllers for electrical Transmission systems- R.M. Mathur, R.K. Verma, Wieldy inter science, 2002

MAHAKAUSHAL UNIVERSITY JABALPUR

ADVANCED COURSE IN ELECTRICAL MACHINE

UNIT- I **Marks : 14**

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, equation of cross field commutator machine.

UNIT- II **Marks : 14**

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.

UNIT- III **Marks : 14**

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.

UNIT- IV **Marks : 14**

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.

UNIT- V **Marks : 14**

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.

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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

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.)

Power electronics Lab

S. No.	Objective
1	To obtain V-I characteristics of an SCR and determine its triggering voltage.
2	To analyze the switching behavior of DIAC and TRIAC under different triggering conditions.
3	To plot output and transfer characteristics and understand their switching properties.
4	To convert AC to DC using SCR and study waveforms for resistive and inductive loads.
5	To study performance and ripple factor of full converter using SCRs.
6	To analyze operation and output waveform of a single-phase bridge inverter.
7	To convert fixed AC frequency to variable AC frequency and observe waveforms.
8	To step down DC voltage and study output voltage variation with duty cycle.
9	To step up DC voltage and study the effect of switching frequency and duty ratio.
10	To control DC motor speed using a DC-DC converter circuit.
11	To study variable frequency drive (VFD) operation for AC motor speed control.
12	To simulate rectifiers, choppers, and inverters using simulation software.
13	To control AC load voltage using phase control technique.
14	To analyze output waveforms and power factor.
15	To study the conversion of 3-phase AC to DC and observe output waveforms.

Power System Laboratory

S.No.	Objective
1	To study short, medium, and long transmission line models and determine voltage regulation and efficiency.
2	To perform load flow analysis using Gauss-Seidel or Newton-Raphson method.
3	To study and verify the Ferranti effect on a long transmission line.
4	To determine fault current under symmetrical (three-phase) fault conditions.
5	To study single line-to-ground, line-to-line, and double line-to-ground faults.
6	To study the effect of line parameters on voltage and current.
7	To plot the power circle diagram for a transmission line.
8	To measure positive, negative, and zero-sequence impedances of synchronous machines.
9	To determine characteristics of overcurrent, differential, or distance relays.
10	To study single area and two-area load frequency control systems.
11	To determine optimal load sharing among generators using economic load dispatch.
12	To study voltage improvement using shunt capacitors or synchronous condensers.
13	To study the effect of power factor improvement on system efficiency.
14	To calculate transmission line parameters using two-port network theory.
15	To study the transient and steady-state stability of a power system.

MAHAKAUSHAL UNIVERSITY JABALPUR

REACTIVE POWER CONTROL & FACTS

UNIT- I **Marks : 14**

Description and definition of Introduction to FACTS: Basic Types of ccontrollers – Benefits from FACTS technology- Static Var Compensator (SVC): Principle of operation, configuration and control. Thyristor Controlled Series compensator (TCSC): Principle of operation, configuration and control, Application for damping electromechanical Oscillations, Application for mitigation of SSR..

UNIT- II **Marks : 14**

Static Compensator (STATCOM): Principle of operation, configuration and control. Static Synchronous Series Compensator (SSSC): Principle of operation, configuration and control. Thyristor Controlled Phase Angle Regulator (TCPAR): Principle of operation, configuration and control, Unified Power Flow Controller (UPFC): Principle of operation, configuration and control, Simulation of UPFC, Steady state model of UPFC. Interline Power Flow Controller (IPFC): Principle of operation, configuration and control.

.UNIT- III **Marks : 14**

Oscillation Stability Analysis and Control: Introduction – Linearised model of power systems installed with FACTS based Stabilisers – Heffron-Phillips model of a SMIB system installed with SVC, TCSC and TCPS – Heffron-Phillips model of a SMIB system with UPFC – Heffron-Phillips model of a Multi-machine system installed with SVC, TCSC and TCPS.

UNIT- IV **Marks : 14**

Analysis and Design of FACTS based stabilisers: Analysis of damping torque contribution by FACTS based stabilisers installed in SMIB systems, Design of robust FACTS based stabilisers installed in SMIB systems by phase compensation method. Selection of installing locations and feed back signal for FACTS based stabilizers

UNIT- V **Marks : 14**

Transient Stability control with FACTS: Introduction – Analysis of Power systems installed with FACTS devices: Power transmission control using Controllable Series Compensation(CSC), Power Transmission Control using SSSC, Power Transmission Control using UPFC, Power Transmission Control using Phase Shifting Transformer(PST), Power Transmission Control using UPFC, Control of FACTS devices for transient stability improvement – General considerations of FACTS control strategy: CSC,SSSC, SVC, STATCOM and UPFC control strategy – General Structure of the FACTS devices control.

Reference Books

1. Reactive Power Control in Power Systems, T J E Miller John Wiley.
2. Computer modeling of Electrical Power Systems, J Arriliga, N R Watson, Wiley
3. Understanding FACTS' N G Hingorani and L Gyugyi, IEEE Press.
4. Flexible ac Transmission Systems (FACTS), Y.H. Song, A.T.Johns,IEEE P

MAHAKAUSHAL UNIVERSITY JABALPUR

ENERGY CONSERVATION AND MANAGEMENT

UNIT- I **Marks : 14**

General energy problem: Energy use patterns and scope for conservation. Energy audit: Energy monitoring, Energy accounting and analysis, Auditing and targeting. Energy conservation policy, Energy management & audit, Energy audit, Types of energy audit, energy management (audit), qualities and function of energy managers, language of an energy manager, Questionnaire, Check list for top management, Loss of energy in material flow, energy performance, Maximizing system efficiency, Optimizing, input energy requirements, Energy auditing instruments, Material load energy balance diagram.

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UNIT- II **Marks : 14**

Thermodynamics of Energy Conservation, Basic principle, Irreversibility and second law, efficiency analysis of systems, Primary energy sources, optimum use of prime-movers, energy efficient house keeping, energy recovery in thermal systems, waste heat recovery techniques, thermal insulation, Thermal energy audit in heating, ventilation and air conditioning. Maintenance and Energy audit, friction, lubrication and tribo-logical innovations. Predictive and preventive maintenance

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UNIT- III **Marks : 14**

Load curve analysis & load management DSM, Energy storage for power systems (Mechanical, Thermal, Electrical & Magnetic) Restructuring of electric tariff from energy conservation consideration, Economic analysis depreciation method, time value of money, Evaluation method of projects, replacement analysis, special problems inflation risk analysis, Pay back period, Energy economics, Cost Benefit Risk analysis, Pay back period.

UNIT- IV **Marks : 14**

Energy efficient electric drives, Energy efficient motors V.S.D. power factor improvement in power system, Energy Conservation in transportation system especially in electric vehicle. Energy flow networks, Simulation & modeling, formulation & Objective & constraints, alternative option, Matrix chart.

UNIT – V **Marks:14**

Energy conservation task before industry, Energy conservation equipments, Co-Generation, Energy conservation in Sugar, Textiles, Cement, process industry, Electrical Energy Conservation in building, heating, lighting, domestic gadgets

Reference Books

1. Energy Management – W.R. Murphy & G. Mckey Butler worths.
2. Energy Management Head Book- W.C. Turner, John Wiley
3. Energy Management Principles- Craig B. Smith, Pergamon Press
4. Energy Conservation- Paul O Callagan- Pergamon Press
5. Design & Management of energy conservation. Callaghan,

Elect, Energy Utilization & Conservation. Dr. Tripathi S.C.,

MAHAKAUSHAL UNIVERSITY JABALPUR

POWER QUALITY AND CONDITIONING

UNIT- I **Marks : 14**

Understanding Power quality, types of power quality disturbances, power quality indices, Causes and effects of power quality disturbances

UNIT- II **Marks : 14**

Causes and effects of harmonics, converter configuration and their contribution to supply harmonics, other sources of harmonics

UNIT- III **Marks : 14**

Radio interference, supply standards, elimination/suppression of harmonics, classical solutions & their drawbacks, passive input filters,design of harmonic filters,Improved power quality converter topologies,(single and three phase),

UNIT- IV **Marks : 14**

transformer connections, Elimination/suppression of harmonics using active power filters – topologies, and their control methods, PWM converter as a voltage source active filter, current source active filter,

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UNIT –V **Marks:14**

Active waveshaping of input line current, constant frequency control, constant tolerance band control, variable tolerance band control, discontinuous current control,Electromagnetic interference(EMI), EMI generation ,EMI standards,and elimination.

Reference Books

1. Power Quality – by R.C. Duggan
2. Power system harmonics – by A.J. Arrillga
3. Power electronic converter harmonics – by Derek A. Paice
4. Power Electronics –Mohan,Undeland,Robbins

MAHAKAUSHAL UNIVERSITY JABALPUR

RESTRUCTURED POWER SYSTEMS

UNIT- I **Marks : 14**

Fundamentals of restructured system, Market Architecture, Load Elasticity, Social welfare maximization.

UNIT- II **Marks : 14**

OPF: Role in vertically integrated systems and in restructured markets, Congestion Management.

UNIT- III **Marks : 14**

Optimal Bidding, Risk assessment and Hedging, Transmission Pricing and Tracing of power.

UNIT- IV **Marks : 14**

Ancillary Services, Standard Market Design, Distributed Generation in restructured markets.

UNIT- V **Marks : 14**

Developments in India, IT applications in restructured markets, Working of restructured power systems : PJM.

Reference Books

1. Understanding electric utilities and de-regulation, Lorrin Philipson, H. Lee Willis, Marcel Dekker Pub., 1998.
2. Power system economics: designing markets for electricity Steven Stoft, John Wiley & Sons, 2002
3. Operation of restructured power systems. Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen
4. Restructured electrical power systems: operation, trading and volatility Mohammad Shahidehpour

MAHAKAUSHAL UNIVERSITY JABALPUR

POWER SYSTEM TRANSIENTS

UNIT- I **Marks : 14**

Origin and nature of transients and surges. Equivalent circuit representations. Lumped and distributed circuit transients. Line energization and de-energisation transients. Earth and earth wire effects.

UNIT- II **Marks : 14**

Current chopping in circuit breakers. Short line fault condition and its relation to circuit breaker duty. Trapped charge effects. Effect of source and source representation in short line fault studies. Control of transients.

UNIT- III **Marks : 14**

Lightning phenomena. Influence of tower footing resistance and earth resistance. Traveling waves in distributed parameter multi-conductor lines, parameters as a function of frequency.

UNIT- IV **Marks : 14**

Simulation of surge diverters in transient analysis. Influence of pole opening and pole closing. Fourier integral and Z transform methods in power system transients. Bergeron methods of analysis and use of EMTP and EMTDC/PSCAD package

UNIT- V **Marks : 14**

Insulation Coordination : overvoltage limiting devices, dielectric properties, breakdown of gaseous insulation, tracking and erosion of insulation, high current arcs.

1. Power System Transients by Vanikov
2. Power System Transients by C. S. Indulkar and D.P. Kothari
3. Power Circuit breaker theory and design by Flurscheim C.H.
4. EMTP Rulebook
5. EMTDC/PSCAD Rulebook

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.)

Advanced Power System Lab

No.	Objective
1	Solve steady-state bus voltages, power injections and line flows for a sample system.
2	Calculate currents and voltages for single-line-to-ground, line-to-line and three-phase faults.
3	Simulate generator angle stability after a disturbance and study critical clearing time.
4	Determine modes/damping of a multi-machine system and modal participation.
5	Test overcurrent, distance, and differential relays; perform coordination study.
6	Study trip characteristics of distance relays under different fault conditions.
7	Verify transformer differential relay operation and restraint under inrush.
8	Identify machine parameters and validate equivalent circuit.
9	Model a simple HVDC link; study control of rectifier/inverter and power transfer.
10	Study voltage/reactive control and damping effects using FACTS controllers.
11	Study PWM converters, inverter control, and grid injection characteristics.
12	Investigate PV curves and collapse scenarios under varying loads.
13	Acquire and analyze PMU data; measure phase angles and system coherency.
14	Implement state estimator and detect/identify bad measurements.
15	Solve generation dispatch for minimum cost subject to constraints.

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.)

list of experiments for Computer Applications in Power System Lab

S. No.	Objective / Description
1	To determine bus voltages, power flow, and losses using the Gauss-Seidel iterative method.
2	To perform load flow study using Newton-Raphson method and compare with Gauss-Seidel.
3	To analyze system performance using the fast decoupled load flow method.
4	To determine fault currents and bus voltages for different fault types.
5	To allocate generation among units economically while satisfying demand.
6	To minimize total generation cost using gradient search.
7	To schedule generating units for minimum cost operation.
8	To compute ABCD constants and voltage regulation for a transmission line.
9	To study transient stability using equal area criterion or numerical methods.
10	To determine optimal generation scheduling considering losses and cost.

MAHAKAUSHAL UNIVERSITY JABALPUR

Power System Instrumentation

UNIT I **Marks : 14**

Introduction to instrumentation and control of energy systems, display instruments, recorders.

UNIT II **Marks : 14**

Transducers, sensors, actuators such as pressure, temperature, velocity, speed, volume, torque and solar flux measuring devices, current, voltage and power factor.

UNIT III **Marks : 14**

Gas analysers, power plants and industrial instrumentation and pollution monitoring devices.

UNIT IV **Marks : 14**

Signal conditioning of inputs, single channel and multichannel data acquisition system, D/A and A/D converters, data loggers, supervisory control.

UNIT V **Marks : 14**

Data transmission systems, Advantage and disadvantage of digital transmission over anolog. Time division multiplexing, pulse modulation, digital modulation.

Reference Books:

1. Transducers & Instrumentation by D.V.S. Murty – PHI Prentice Hall
2. Electronic Instrumentation by H.S.Kalsi – Tata McGraw Hill
3. Electrical and Electronics Measurement and Instr., A.K.Sawhney, Dhanpat Rai 4.
4. Instrumentation devices and systems by C.S.Rangan and G.R. Sharma, TMH

MAHAKAUSHAL UNIVERSITY JABALPUR

DSP AND ITS APPLICATION

UNIT I **Marks : 14**

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.

UNIT II **Marks : 14**

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.

UNIT III **Marks : 14**

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.

UNIT IV **Marks : 14**

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.

UNIT V **Marks : 14**

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
Analog & Digital Signal Processing – Ashok Ambardar

MAHAKAUSHAL UNIVERSITY JABALPUR

Power Controller

UNIT I **Marks : 14**

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.

UNIT II **Marks : 14**

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.

UNIT III **Marks : 14**

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

UNIT IV **Marks : 14**

Detailed analysis of 1-φ VSI, 3-φ VSI (180° mode, 150° mode & 120° mode of conduction), various invertercommutation circuits, harmonic reduction techniques, PWM inverters, Inverters for HVDC application &ACdrives. Advantages & limitation of current source inverters over VSI, 1-ö and 3-ö CSI. Resonant inverters.

UNIT V **Marks : 14**

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 ofpower 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

MAHAKAUSHAL UNIVERSITY JABALPUR

SPECIAL MACHINES

UNIT I **Marks : 14**

Square wave permanent magnet brushless dc motor, magnetic circuit analysis on open circuit torque & emf equations, torque speed characteristics, efficiency, commutation, winding inductances, armature reaction and controllers.

UNIT II **Marks : 14**

Sine wave permanent magnet brushless dc motor, torque & emf equation, Inductance of phase winding, synchronous reactance, phasor diagram, torque-speed characteristics.

UNIT III **Marks : 14**

Switched reluctance motor, static torque production, partition of energy and the effects of saturation, Dynamic torque production, torque speed characteristics, shaft position sensing, solid rotors.

UNIT IV **Marks : 14**

Linear Induction Motors, construction, performance, thrust-speed characteristic, application, end effect.

UNIT V **Marks : 14**

Stepper motor – variable reluctance stepper motor, single stack stepper motor multistack stepper motor, permanent magnet stepper motor, Important features of stepper motor, torque v/s stepping rate characteristics, Drive circuits, unipolar drive circuits, Bipolar drive circuits.

Reference Books:

1. Brushless Permanent Magnet & Reluctance Motor Drives – T.J.E.Miller
2. Principles of Electric Machines & Power Electronics – P.C.Sen
6. Electric Drives – G.K.Dubey

MAHAKAUSHAL UNIVERSITY JABALPUR

ADVANCED ELECTRICAL DRIVES

UNIT I **Marks : 14**

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

UNIT II **Marks : 14**

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

UNIT III **Marks : 14**

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, Breaking, Introduction of transient analysis. Speed control methods, single phase I.M. Close loop control of I.M. Drives.

UNIT IV **Marks : 14**

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

UNIT V **Marks : 14**

Introduction of Brushless dc motor, stepper motor and switch reluctance motor drives, solar and battery powered drives, Traction Drives, Energy conservation in Electrical Drives.

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

Seminar

you should actively participate by contributing to discussions, preparing beforehand by completing readings, and engaging with complex ideas. Be ready to present your work, ask clarifying questions, and build on the points made by others to gain a deeper understanding of the subject.

Dissertation Part- I

In the dissertation part-I you have to select a topic, write a research synopsis including a problem statement and objectives, and present it to a panel. The synopsis will introduce the research area, discuss the literature review, and outline the problem you plan to solve, along with the methodology you will use. This part concludes with a presentation, where your supervisor and a panel of faculty will evaluate your synopsis, which will be graded.

MAHAKAUSHAL UNIVERSITY, JABALPUR (M.P.)

Dissertation Part- II

The objectives of the course 'dissertation part-II' are

- To provide students with a comprehensive experience for applying the knowledge
- gained so far by studying various courses.
- To develop an inquiring aptitude and build confidence among students by working on
- solutions of small industrial problems.
- To give students an opportunity to do some thing creative and to assimilate real life
- work situation in institution.
- To adapt students for latest developments and to handle independently new situations.
- To develop good expressions power and presentation abilities in students.
- The focus of the Major Project is on preparing a working system or some design or
- understanding of a complex system using system analysis tools and submit it the same in the
- form of a write-up i.e. detail project report. The student should select some real life problems
- for their project and maintain proper documentation of different stages of project such as need
- analysis, market analysis, concept evaluation, requirement specification, objectives, work plan,
- analysis, design, implementation and test plan. Each student is required to prepare a project
- report and present the same at the final examination with a demonstration of the working
- system (if any).
- The faculty and student should work according to following schedule:
    - Each student undertakes substantial and individual project in an approved area of the
- subject and supervised by a member of staff.
    - The student must submit outline and action plan for the project execution (time schedule)
- and the same be approved by the concerned faculty.
    - At all the steps of the project, students must submit a written report of the same.