3EP200PC – Numerical Methods and Optimization Techniques

Course Outcomes:

After completing this course students will be able to

1. Solve linear and Simultaneous Equations with the help of Numerical Methods.
2. Apply various Numerical methods to fit the curve.
3. Solve Numerical differentiation, integration, and Differential Equations.
4. Solve linear, non-linear and problem by various methods.
5. Determine the optimum scheduling by using CPM and PERT.

Syllabus:

Unit I:

a) Absolute, relative and percentage errors and analysis, Solution of Algebraic and Transcendental equations: Bisection Method, False Position method, Newton Raphson methods.

b) Solution of Simultaneous Algebraic Equations: matrix inverse method, Gauss elimination method, Iterative method-Jacobi's Method, Gauss Seidel Method, Eigen values of matrix.

Unit II:

a) Curve fitting by Least Square Method, Correlations and Regression.

b) Newton's forward and backward interpolation method, Newton's Divided Difference Method, Lagrange's Interpolation method, Interpolation with Cubic Splines.

Unit- III:

Numerical differentiation by Taylor series method, Maximum and minimum values, Numerical Integration by Trapezoidal, Simpsons one third and three eight rules, Numerical solution to differential equations by Taylor Series, Euler's method, Runge Kutta Second and Fourth order methods.

Unit– IV:

Basics of Optimization Techniques, Linear programming - standard form, definitions and theorems, graphical method, simplex method, duality, theorems on duality, dual simplex method.

Unit-V:

a) IBFS of Balanced and Unbalanced Transportation problems- NWCR, Matrix minima Method, Column Minima Method, Row Minima Method, Vogel's Approximation Method.

b) Nonlinear programming: unimodal function, Fibonacci search method and golden section method, steepest descent method.

Unit-VI:
CPM and PERT: introduction, Network representation of project, critical path, Probability of completion of Project, Optimum Scheduling by CPM, Crashing of Project.

Books Recommended:

Text Books:

1. Introductory Methods of Numerical Analysis; S. S. Sastry (PHI)
2. Engineering Optimization–Theory & Practice; S. S. Rao, New Age International Pvt. Ltd.

Reference Books:

1. Mathematical Statistics by J. N. Kapoor, Tata McGraw Hill Pub. Co. Ltd
2. Numerical Methods in Engineering and Science; B. S. Grewal (Khanna Publishers)
3. PERT and CPM-Principles & Application, L. S. Srinath, East-West Press Pvt. Ltd.
4. Optimization for Engineering Design-Algorithms and Examples byKalyan Moy Deb, PHI

3EE201PC/3EP201PC - Electrical Circuit Analysis

Course Outcomes:

After completing this course student will be able to:

1. Analyze electric circuit using basic circuital laws
2. Analyze the circuit using Network simplification theorems.
3. Solve circuit problems using concepts of electric network topology.
4. Evaluate transient response of different circuits using Laplace transform
5. Evaluate two-port network parameters and network functions

Syllabus:

Unit-I:

A] Terminal Element Relationships: V-I relationship for Dependent & Independent (Voltage and Current) Sources. Source Transformations.

Magnetic Circuits: concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit, Analysis of series and parallel magnetic circuits.

B] Node and Mesh Analysis: Introduction, Node analysis, super node analysis, mesh analysis, super mesh analysis.

Unit-II:

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Substitution theorem.

Unit-III:

Graph Theory and Network Equation: Graph of a network, Trees and loops, Tie-set and cut set matrix of a network, Incidence Matrix, Network equilibrium equations, Duality-network transformation, Tellegen's theorem.

Unit-IV

Transformation of a Circuit into s-domain: Review of Laplace transform, source function (Unit step, ramp, Gate, Impulse), Laplace transform of periodic signals, Transformed equivalent of inductance, capacitance and mutual inductance, Impedance and admittance in the transform domain, Node Analysis and Mesh Analysis of the transformed circuit. Solve Linear Differential Equations for Series RC, Parallel RC, Series RL, and Parallel RL.

Unit-V:

Two Port Networks: Open circuit impedance parameters, Short circuit admittance parameters, Transmission parameters, Hybrid Parameters, Condition for reciprocity and symmetry of a two port network, Interrelationship between parameters, Interconnection of two port networks, Input impedance in terms of two port network parameters.

Unit-VI:

Network functions: Ports and terminal pairs, Network functions, poles and zeros, Necessary conditions for driving point function, Necessary conditions for transfer function. Applications of network analysis in driving network functions, positive real functions, driving point and transfer impedance function.

Text Book:

1. Network and System, D Roy Chaudhury. New Age International, 2010
2. Network Analysis, M.E. Van Valkenburg, PHI, 2005.

Reference Books:

1. Circuits & Networks – Analysis, Design & Synthesis by M. S. Sukhija, T. K. Nagasarkar, Oxford University Press, 2010.
2. Circuit and Network Analysis, Sudhakar Shyammohan, Tata Mc Graw Hill, 2005.
3. Network Analysis, P. Ramesh babu, SciTech Publications, Chennai, 2009.
4. Network Analysis and Synthesis by Ravish R Singh TMH Publication

3EE202PC/3EP202PC- Electrical Measurements & Instrumentation

Course Outcomes:

A student completing this course, will be able to:

1. Explain the various measuring instruments like PMMC, MI, Electrodynamometer, and Induction type instruments.
2. Demonstrate the construction & working of Instrument Transformers and special purpose meters.
3. Analyze various methods for measurement of resistance, inductance, and capacitance using AC/DC bridges.
4. Explain the working of various Digital measuring instruments.
5. Explain the generalized Instrumentation system & working of different transducers.

Syllabus:

Unit-I: Analog Instruments - Classification of measuring instrument, Different torques in measuring instrument, Construction, theory of operation, torque equation, errors, merits and demerits of analog Ammeter, Voltmeter (PMMC, MI instruments) and Electrodynamic type meter. Extension of ranges for ammeter & voltmeter.

Unit II: Wattmeter and Energy meter-Construction, theory of operation, torque equation, errors, merits and demerits.

Analysis of three phase balanced load: - Blondell's theorem, Measurement of active and reactive power in single phase and three phase circuits.

Unit III: Instrument transformers- C.T. and P.T., Importance, theory and construction, phasor diagram, errors and applications.

Special Instruments- Phase sequence indicator, power factor meter, Synchroscope and Stroboscope.

Unit IV: Measurement of circuit parameters- Different methods of measurement of low, medium, high value of resistance.

AC and DC bridges - Wheat -stone, Kelvin, Maxwell, Hay, De-Sauty, Schering, Anderson's bridge.

Unit V: Digital methods of measurements - Introduction to A/D, D/A conversion techniques, F/V and V/F conversion techniques, Digital voltmeter, ammeter, wattmeter, electronic energy meter, errors in digital meters.

Unit VI: Generalized Instrumentation system- characteristics of measurement and Instrumentation system.

Transducers: Definition, classification, Specification, selection, loading effect, Displacement, velocity transducers, Resistive, inductive, Capacitive, strain gauge transducers, Piezoelectric, current and voltage transducers. Elastic-members (Bellows, Bourdon tube, Diaphragm)

Text Book:

1. A.K. Sawhney, 'Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai& Co (P) Ltd.

Reference Books:

1. E.W. Golding& F. C. Widdis, 'Electrical Measurements & Measuring Instruments', A. H. Wheeler & Co.
2. Albert D. Helfrick& William D. Cooper, 'Modern Electronic Instrumentation & Measurement Techniques', Prentice Hall of India.
3. Joseph. J. Carr, 'Elements of Electronic Instrumentation & Measurements', III edition, Pearson Education.
4. Bouwens, A.J., "Digital Instrumentation", McGraw Hill Publications

3EE203EL/3EP203EL - Community Engagement Project/ Field project (related to Major)

Every student required to complete one Community Engagement/field project related to Electrical Engineering domain

3EE204PC/3EP204PC - Electrical Circuit Analysis Lab

Conduct minimum eight experiments based on the syllabus of Electrical Circuit Analysis subject (3EP201PC)

3EE205PC/3EP205PC - Electrical Measurement and Instrumentation Lab

Conduct minimum eight experiments based on the syllabus of Electrical Measurement and Instrumentation subject (3EP202PC)

3EE206M/3EP206M - Electrical Energy Generation

Course Outcome

After successful completion of this course, a student will be able to:

1. Explain the current energy scenario in India and the various load- Generation factors.
2. Illustrate the working of Thermal, Hydro & Nuclear power plants.
3. Explain the working of solar & Wind energy conversion systems.

Syllabus:

Unit I

Introduction to Indian Energy Scenario,

Load-Generation factors: connected load, maximum demand, demand factor, load factor, diversity factors, plant capacity and utilization factor load curve, chronological load curve, load duration curve, base load & Peak load.

Thermal power plant: Layout of Thermal power plant, Selection of site, working of various parts: Economizer, air preheater, condenser, cooling tower, ash & coal handling plant, advantages & disadvantages.

Unit II

Hydro power plant Layout of Hydro power plant, classification of hydro power plant according to available head, nature of load, functions of different components and their working, mini and micro hydro-electric power generation, advantages & disadvantages.

Nuclear power plant: Layout of Nuclear power plant, Selection of site, Functions of different components of nuclear plant, types of nuclear reactors, advantages & disadvantages of different nuclear reactors, nuclear waste disposal, safety measures.

Unit III

Renewable Energy Resources:

Solar Energy: Solar cell, array & module, Solar constants, solar radiation, solar radiation measurement, estimation of average solar radiation, principle of solar energy conversion in to heat, types of solar collectors, energy balance equation and collector efficiency. Calculations for domestic roof top solar plant.

Wind energy: Basic principle of wind energy conversion, wind data and energy estimation, selection of site, basic components of wind energy conversion system, classification of WEC systems

Text Book:

1. Generation of electrical energy by B. R. Gupta, Eurasia Publishing House, New Delhi

Reference Books:

1. Non-conventional energy resources. By G. D. Rai, Khanna Publishers New Delhi
2. Solar energy by S.P. Sukhatme Tata McGraw Hill Publication
3. Principles of Power System by V.K. Mehta, S. Chand publication.
4. Elements of Electrical power station design by M.V. Deshpande, Wheeler Publishing
5. Conventional energy technology by S.B. Pandya, Tata McGraw Hill Publication.

3EE207OE/3EP207OE - Power Supply System

Course Outcome

After successful completion of this course, a student will be able to:

1. Explain the working of thermal & Hydro-electric power plants.
2. Understand the basics of solar and wind energy and their conversion.
3. Demonstrate the knowledge of various types of substations and distribution systems
4. Demonstrate the knowledge of electrical wiring installation and earthing system.

Syllabus:

Unit I: Thermal power stations: Schematic diagram, main parts and their working, site selection criteria.
Hydroelectric stations: Schematic diagram, location of hydroelectric stations, site selection, types of hydro power plant, principles of working, types of turbines. Pumped storage hydro power plants.

Unit II: Introduction to Solar Energy: Solar cell, array & module, Solar constants, Solar radiation geometry, solar radiation on tilted surface, introduction to solar radiation measurement devices, principle of solar energy conversion into heat, types of solar collectors.
Introduction to Wind energy: Basic principle of wind energy conversion, selection of site, basic components of wind energy conversion system, classification of WEC systems, applications of wind energy.

Unit III: Substation - Classification of substations, Major equipment in Substation, Selection & location of site for substation, Main Electrical connections, Graphical symbols for various apparatus & circuit elements in substation. Key diagram for typical substation, Busbar layouts. Auxiliary supply.

Unit IV: Power distribution system: Primary and secondary distribution, types of conductors in Distribution system, comparison of distribution systems. Distributor design, radial and ring main, current and voltage profiles along a distributor.

Unit V: Electrical wiring and installation: Factors affecting selection of wiring, Types of internal wiring and its accessories, Cleat wiring, Batten Wiring, Casing and Capping wiring, Conduit wiring. Connection of Staircase wiring and Godown wiring, main, sub-main and sub-circuit wiring. Types of Conductors, Fuse and disconnecting devices.

Unit VI: Earthing: Introduction, Effects of Electric Currents on human body, Grounding Resistance, Touch and step Potential, Size of earthing conductor, Introduction to neutral earthing, Grounded and Effectively Grounded System, Various types of grounding, Neutral Grounding Practices.

Text Book

1. Principles of Power System by V. K. Mehta. S. Chand Publication
2. Generation of Electrical Energy by B. R. Gupta. S. Chand Publication

Reference Books:

1. A Course in Electrical Power by J. B. Gupta. S. K. Kataria and Sons Publications.
2. Electrical Power System Design by M. V. Deshpande, McGraw Hill Publications.
3. Electrical Installation Estimating & Costing by J.B.Gupta. S. K. Kataria and Sons

3EE208EM/3EP208EM - Entrepreneurship Development

Course Outcomes:

On successful completion of this course, the students will be able to:

1. Explain the fundamentals of entrepreneurship and its role in economic development.
2. Apply innovation and design thinking to develop business ideas.
3. Prepare a feasibility study and basic business plan for entrepreneurial ventures.

Syllabus:

Unit I: Fundamentals of Entrepreneurship

Definition and Characteristics of Entrepreneurship, Types of Entrepreneurs: Startup Entrepreneurs, Social Entrepreneurs, Technopreneurs, Role of Entrepreneurship in Economic Development, Entrepreneurial Competencies and Traits, Difference Between Entrepreneur and Manager, Problems faced by Entrepreneurs, Myths and Misconceptions About Entrepreneurship

Unit II: Entrepreneurial Process and Innovation

Steps in the Entrepreneurial Process: Opportunity Identification, Idea Generation, and Validation, Feasibility Study: Market, Technical, and Financial Feasibility, Business Model Development: Business Model Canvas (BMC), Role of Innovation in Entrepreneurship, Introduction to Design Thinking for Problem Solving, Overview of Intellectual Property Rights (IPR)

Unit III: Business Planning and Startup Ecosystem

Importance and Components of a Business Plan: Executive Summary, Marketing Plan, and Financial Plan, Legal Structures for Startups: Sole Proprietorship, Partnership, and Company, Government Support for Entrepreneurs: Startup India, Make in India, MSME, and DIC, Role of Incubators, Accelerators, and Venture Capitalists, Elevator Pitch and Presentation Skills for Business Ideas, Introduction to Emerging Trends: Social Entrepreneurship and Green Entrepreneurship

Textbook:

1. "Entrepreneurship Development and Small Business Enterprises" by Poornima M. Charantimath, Pearson Education.

Reference Books:

1. "Entrepreneurship" by Hisrich, Peters, and Shepherd, McGraw-Hill Publication
2. "Innovation and Entrepreneurship" by Peter F. Drucker.
3. “Entrepreneurial Development” by Dr. S. S. Khanka, S. Chand Publication
4. Government Resources on Entrepreneurship (e.g., startupindia.gov.in)

3EE209VE/3EP209VE - Environmental Science

Course Outcome:

Upon successful completion of the course the students will be able to

1. Understand the multidisciplinary nature of environment and Renewable and non-renewable resources
2. Understand natural environment and its relationship with human activities.
3. Understand the basic concepts and problems and follow sustainable development practices.

Syllabus

Unit I: Renewable and non-renewable resources

Environmental Science, Definition, scope and importance, Need for public awareness, Renewable and non-renewable resources, Natural resources and associated problems. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit II: Ecosystems:

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem

Unit III: Social Issues and the Environment:

From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns.

Environmental ethics: Issues and possible solutions, Environment Protection Act. Air (Prevention and Control of Pollution) Act., Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, public awareness.

Textbooks:

1. Textbook for Environmental studies by Erach Bharucha for UGC
2. Textbook of Environmental studies by Shanta Satyanarayan, Dr. Suresh Zade, Dr. Shashikant Sitre & Dr. Pravin Meshram Allied Publishers

Reference Books:

1. Essentials of Ecology and Environmental Science by Dr. S. V. S. Rana, PHI Learning Pvt. Ltd, Delhi
2. Environmental Chemistry by Anil Kumar De, Wiley Eastern Limited

3. Environmental Science by T.G. Miller, Wadsworth Publishing Co, 13th edition.
4. Ecology and Environment by P. D. Sharma, Rastogi publications
5. Fundamental concepts in Environmental studies by Dr. D.D. Mishra. S. Chand publications
6. Perspectives in environmental studies by A. Kaushik and C. P. Kaushik. New Age International (P) Limited,

4EE209PC/4EP209PC- Electrical Machine – I

Course Outcomes:

After Completion of this course, students will be able to:

1. **Explain** the Construction, working operation, of DC Machines.
2. **Illustrate** the different Characteristics, types, their Application and Parallel Operation of DC Generator.
3. **Demonstrate** the various types of DC motor, characteristics, starting method, testing method, speed control method and braking operation on DC motors.
4. **Explain** the Construction, working, types of Single-Phase Transformer and testing of Single-phase transformer.
5. **Explain** the Construction, working, different connections, applications and testing of three phase transformers.

Syllabus

Unit I: D.C. Machines:

Construction, Principle of Operation, EMF Equation, Torque Equation. Armature winding – Lap, wave, single layer, double layer. Armature Reaction and commutation, method of improving commutation.

Unit II: D.C. Generators:

Types- Separately & Self Excited generator, Characteristics- OCC, internal & External, Applications of D. C. Generators, Parallel Operation of Series, Shunt & Compound D.C. Generators, testing of DC Generators.

Unit III: D.C. Motors:

Types- Series, Shunt & Compound Motor, Characteristics of DC Motor, Applications of D.C. motors. Starting, Electric Braking, Speed Control of DC Motors. testing of DC Motors, Losses, efficiency.

Unit IV: Single phase Transformer:

Working Operation, EMF Equation, and separation of core losses, Equivalent Circuit, Phasor diagram, Parallel Operation. Open Circuit, Short Circuit & Sumpner's test on single phase transformer.

Single phase Autotransformer: - construction, working, merits, demerits and its application.

Unit V: Three Phase Transformer:

Construction, Working, Types, connections, vector groups, open delta Connection, Open Circuit test, Short Circuit test, load test, magnetic balance test.

Unit VI:
On load & Off load tap changers, Scott Connection, Power transformer and Distribution transformer. Three-winding transformer, Magnetising inrush current phenomenon.

Books Recommended:

Text Books:
1) Nagrath & Kothari: Electrical Machines, (Tata McGraw-Hill Book Comp. Delhi.)
2) J. B Gupta: Theory Electrical machines, (Katria Publication)

Reference Books:
1) C. Dawes: Electrical Engineering Vol. I : Direct current (IV Edition), McGraw Hill Book Company
2) P. S. Bimbhra: Electrical Machinary, Khanna Publisher
3) Clayton and Hancok: Performance and design of d.c. machines

Proposed Syllabus for V Semester

BE Electrical Engineering (Electronics & Power) – NEP Scheme

5EP220PC - Electronics Components & Circuits

Course Outcomes:

After successfully completing the course, the students will be able to

1. Explain the operation and characteristics of PN junction and Zener diodes.
2. Develop the rectifier circuits with and without filters.
3. Illustrate the operation and performance characteristics of BJT.
4. Make use of Op-amp for linear and nonlinear circuits.
5. Explain the operation and applications of voltage regulators and timer ICs.
6. Demonstrate the knowledge of combinational and sequential circuits for digital applications

UNIT-I: Basics of Semiconductor Devices:
Review and types of semiconductors, PN junction diode theory and VI Characteristics, Zener diode, Zener diode as voltage regulator, Numerical based on voltage regulator (line and load regulation)

UNIT-II: Applications of Diodes and UJT:
Half wave, full wave center tapped full wave and bridge rectifier. Filters-C, LC and their analysis, UJT: Characteristics, working, UJT as relaxation oscillator

UNIT-III: Transistor Theory and Applications:
Theory and Analysis of Bipolar Junction transistor, methods of biasing, their needs, Q' and stability factors, Study of amplifier circuit, RC coupled amplifier, Transformer coupled amplifier, Direct coupled amplifier, emitter follower etc.

UNIT-IV: **Introduction to Op-amp:**
Operation amplifier; Block schematic internal circuits, study of IC 741 op-amp parameter. Linear and Non-linear Application of Op-amp: Inverting and non-inverting amplifiers, voltage follower, integrator, differentiator, differential amplifier, Sinusoidal RC-phase shift and comparator circuits using op-amps.

UNIT-V: Regulators & Timer IC's:
Study of 78XX, 79XX and its applications, SMPS, Block schematic of regulator IC 723, and its applications, Block schematic of timer IC 555 and its applications as a timer, a stable, mono stable, bistable-multivibrator.

UNIT-VI: Introduction to digital circuits:
Logic Gates (AND, OR, NOT, NAND, NOR XOR, XNOR) Combinational Digital Circuits: Digital comparator, Decoder / demultiplexer, Data selector / multiplexer, Encoder, Sequential Circuits and Systems: Bistable Latch, Flip-Flop clocked SR,J-K, T, D type.

Text Books:

1. Electronic Devices and Circuits By Sanjeev Gupta, Dhanpat Rai Publications, New Delhi.
2. Gayakwad, R. A., Op-Amps and Linear Integrated Circuits, Pearson Education, New Delhi, 2020
3. R. P. Jain and K. Sarawadekar, Modern Digital Electronics. McGraw-Hill Education (India) Pvt Limited, New Delhi, India,2010

Reference Books:

1. Electronic Devices and Circuits 5/e – David Bell Oxford University Press
2. Microelectronic Circuits 5/3 – Sedranad Smith Oxford University Press
3. Boylestad R. and "Electronics Devices & Circuits", Prentice Hall of India Private Limited, New Delhi (Fifth Edition), 1993.
4. Gayakwad, Op-Amp & LLG, 2nd Ed.
5. Malvino & Leach, Digital Principles & Applications, 4th Ed., McGraw Hill.
6. K. B. Botkar, Integrated Electronics (Khanna Publishers.)

5EP221PC/5EE221PC Electrical Machines – II

Course Outcomes:

After completing this course students will be able to

1. Describe the construction, working principle & performance characteristics of three phase Induction Motor
2. Analyze the starting, braking and speed control of three phase induction motors by various methods.
3. Explain the construction, operation & application of single-phase Induction Motor
4. Demonstrate the construction, working operation & performance characteristics of synchronous machine.
5. Explain the construction & working of special motors like Universal, Reluctance, PMSM & BLDC Motor

Unit I: Three phase induction motor - I

Construction, Types: - Squirrel cage and slip-ring, Rotating Magnetic Fields, principles of operation, Working, slip, Rotor torque, Starting and Maximum Torque, Torque Slip Characteristics, Effect of parameter variation on torque slip characteristics. Equivalent circuit, calculations of parameters of equivalent circuit, Power flow, Phasor Diagram, circle diagram, Performance evaluation by direct & indirect methods.

Unit II: Three phase induction motor - II

Starters for squirrel cage &slip-ring type IM, Methods of speed control, electric braking, High Torque IM, single phasing, cogging and crawling, Induction Generator, Doubly-Fed Induction Generator.

Unit III: Single phase Induction Motor

Double revolving field theory, Constructional features, equivalent circuit, working, Split-phase starting methods and applications of single-phase Induction motors.

Unit IV: Synchronous Generator

Constructional details, working principle, operation, armature reaction, circuit model, determinations of parameters of the circuit model, phasor diagrams, various methods of determining the voltage regulations and efficiency, Parallel operation of alternators - synchronization and load division.

Unit V: Synchronous Motor

Construction, principle of operation, working, starting methods, torque equation - V-curve, Inverted V curve &power angle characteristics, hunting & damping, applications. Transient, sub transient & steady state reactance of synchronous machines.

Unit VI: Special Motors

Construction, working principle, characteristics and applications of Universal motor, Reluctance Motor, Permanent Magnet Synchronous Motor & BLDC Motor.

Text Books:

1. D. P. Kothari & I. J. Nagrath, "Electrical Machines"- 5th Edition, TMH Publication.
2. S. Langsdorf, "Alternating current machines", McGraw Hill Publication

Reference Books:

1. Stephen D. Umans, "Fitzgerald and Kingsley's Electric Machinery", 7th Edition, McGraw Hill Publication, 2020.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
4. C L Dawes, "A Course in Electrical Engineering (Volume -2)", McGraw Hill Publication

5EP222PC/5EE222PC - Power System - I

Course Outcomes –

After successful completion of the course, students will be able to -

1. Determine the parameters of transmission lines.
2. Evaluate the performance of transmission line.
3. Describe transmission line's voltage control and power factor improvement methods.
4. Explain representation of power system, Ferranti effect and corona phenomenon.
5. Demonstrate various Insulators, its string efficiency & underground cables

Unit I: Transmission line parameters –

Calculation of resistance, inductance and capacitance of single phase and three phase transmission lines, skin effect and proximity effect, transposition, G.M.D. & G.M.R. methods, double circuit lines, bundled conductors, effect of earth on inductance and capacitance, interference with communication lines.

Unit II: Electrical characteristics of transmission line –

V-I characteristics of short, medium and long lines, A, B, C, D constants, nominal T and equivalent π representations.

Unit III: Voltage control and power factor improvement –

Methods of voltage control and power factor improvement, use of static VAR generators and synchronous condenser, automatic voltage control. Receiving end and Sending end power circle diagrams.

Unit IV: Representation of power systems –

Single line diagrams, per unit system and one-line impedance and reactance diagrams. Ferranti effect, corona phenomenon, Introduction to Travelling waves.

Unit V: **Insulators –**

Materials used, types, comparison of pin type and suspension type insulators, voltage distribution and string efficiency, methods of increasing string efficiency, grading rings and arcing horns. Introduction to insulator testing, line supports for LV, HV, EHV and UHV.

Unit VI: Underground cables –

Material used for conductor & insulation, different types of cables and their construction, parameters of underground cable, grading of cable, losses, break down and rating, selection of cables.

Textbooks:

1. Modern Power System Analysis by D. P. Kothari, I. J. Nagrath TMH company ltd., New Delhi.
2. Elements of power system analysis by William D. Stevenson, Jr, McGraw-Hill International edition.

Reference Books:

1. Power System Engineering by D. P. Kothari, I. J. Nagrath TMH company ltd., New Delhi
2. Narain G. Hingorani and Lazlo Gyugyi – "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems".
3. Principles of power system by V. K. Mehta, S. Chand & company ltd., New Delhi.
4. Electrical Power Systems by C. L. Wadhwa, New Age International Publishers, New Delhi
5. Electrical Power Systems by Ashfaq Husain, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
6. Electrical Power system Design by M. V. Deshpande, TMH Company Ltd., New Delhi.

Professional Elective – I

5EP223PE1/5EE223PE1 - Advanced Control System

Course Outcome

After completing this course students will be able to
1. Design compensator using time domain and frequency domain specifications
2. Represent system using state space model
3. Analyze controllability and observability for systems and design full state feedback controller.
4. Analyze digital systems using Z Transform
5. Develop the describing function for the nonlinearity to assess the stability of the system.
6. Analyze the Nonlinear system using Phase plane Analysis

Unit I: Compensation Techniques:

Introduction, preliminary consideration of classical design. Lead compensator and Lag Compensator using time domain and frequency domain specifications

Unit II: State Space Technique I:

State, state space and state variables, SISO /MIMO linear systems state Variable models-differential equations, transfer functions, block diagrams and state diagrams. Transfer function decomposition –Phase variable Forms, canonical forms and Jordan canonical forms, STM computation, L.T, Canonical transformation, and Cayley Hamilton theorem. Time Response – SISO systems.

Unit III: State Space Technique II:

Concept-controllability and observability, Gilbert's method and Kalman's test; SISO controllable Systems design –state feedback.

Unit IV: Sampled Data Control Systems:

Representation, Z transform, Sampler and hold, ZOH, Open loop and closed loop SDCS, , difference equation solution, Z transfer Function, Stability Analysis, S and Z domain relationship, Jury's test, and bilinear Transformation.

Unit V: Non-Linear System Analysis I:

Nonlinear system behavior, types and characteristics, Describing function of nonlinearities. Stability Analysis of Non-Linear Systems

Unit VI: Non-Linear System Analysis II:

Linearization, Singular points, Classification and nature, Phase plane method, nonlinear system analysis, Construction of Phase Trajectories–analytical and graphical method by isoclines

Text Books:

1. Nagrath and Gopal, “Control system Engineering” Wiley Eastern Ltd, New Delhi
2. K. Ogata,” Modern Control Theory “Prentice Hall of India Pvt Ltd, New Delhi.

Reference Books:

1. Naresh Sinha. “Control system Engineering” Wiley Eastern Pvt. Ltd., New Delhi.
2. B.C. Kuo. “Automatic Control system “Prentice Hall of India Pvt Ltd Delhi
3. D Roy Choudhury,” “Modern Control Engineering” Publisher: PHI Learning

5EP223PE2/5EE223PE2 - Industrial Automation

Course Outcomes:

After successful completion of this course, students will be able to:

1. Explain the concepts, need, benefits, hierarchy, and components of industrial automation systems.
2. Identify appropriate industrial sensors, actuators, and drives for automation applications.
3. Describe the architecture, working principles, and hardware configuration of PLC systems.
4. Develop basic PLC programs using IEC programming languages and ladder logic.
5. Implement PLC-based control solutions for typical industrial applications such as motor control and process automation.
6. Interpret the role and architecture of SCADA, HMI, and industrial robots in modern automation systems.

Unit I: Introduction to Industrial Automation

Definitions of Automation, Need and benefits of Automation in Industry, Automation Hierarchy, Basic components of automation system, description of each component, Types of automation system: Fixed, programmable, flexible, Different systems for Industrial automation: PLC, SCADA & HMI.

Unit II: Industrial Sensors, Actuators and Drives

Definitions of Sensors, Actuators and Drives, Proximity Sensors, Ultrasonic Sensor, LVDT, Hall effect sensor, Temperature sensor (RTD, Thermocouple, thermistor), Strain Gauge, Flow sensor, Level sensor, load cell, Solenoids, Relays and contactors, stepper motors, servo motors, VFDs.

Unit III: PLC Fundamentals Definitions & history of PLC, building blocks of PLC: CPU, memory organization, Input-output modules (discrete and analog), special I/O modules, power supply, working principles of PLC, applications of PLCs in industries, types of PLCs (compact, modular, rack-mounted), advantages & limitations, selection criteria for PLC, redundancy in PLC module, I/O module selection criteria, interfacing different I/O devices with appropriate I/O modules.

Unit IV: Basics of PLC Programming

IEC Programming Standard, Ladder Diagram, Function Block Diagram, Instruction List and Structured Text, Development of PLC ladder diagram, Basic components & their symbols in ladder diagram, Fundamentals of ladder diagram, Boolean logic & relay logic, Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices, Overview of PLC software.

Unit V: PLC Programming and Applications

Advanced Programming Instructions: Mathematical Instructions, Comparison Instructions, Logical Instructions, Subroutines.

PLC Applications: DOL starter, Star-Delta starter, Forward-Reverse motor control, Conveyor bottle filling, Water level control, Traffic light control.

Unit VI: SCADA, HMI and Introduction to Industrial Robotics

Definition and evolution of SCADA, SCADA architecture, SCADA components, benefits of SCADA, Interfacing SCADA with PLC, Definition and role of HMI in industrial automation, basic Robot architecture, types of robot, industrial applications of robot.

BOOKS RECOMMENDED:

Text Book:

1. Gary Dunning, Cengage, "Introduction to Programmable Logic Controllers", Third Edition, 2006, Learning Pub.
2. Sanjay B Katariya, "Industrial Automation Solutions For PLC, SCADA, Drive and Field Instruments" Notion Press, Chennai, 1st edition (23 May 2020).

Reference Books:

1. Himanshu Kumar, "Advanced Industrial Automation", Notion Press, Chennai (1 July 2020)
2. K. S. Manoj, "Industrial Automation with SCADA", Notion Press, Chennai 2019.
3. Stamatios Manesis, George Nikolakopoulos, "Introduction to Industrial Automation", CRC Press, Tylor & Francis.

5EP223PE3/5EE223PE3- Process Control System

Course Outcomes:

After Completing this course student will be able to

1. Explain the various Electronic Instruments for measurement of electrical parameters.
2. Analyse the different signals
3. Demonstrate the signal counting, recording and working of digital readout devices.
4. Demonstrate the Various techniques of A/D and D/A conversions.
5. Apply various signal processing tools as per requirement
6. Develop ladder diagrams & programmes for PLC

Unit I:

Electronics Instruments for Measurement of Electrical Parameters Advantages of Electronic Instruments, Electronic Voltmeters Electronic Multi-meter, differential volt meter, Digital voltmeter, Q meter, vector impedance meter, vector voltmeter.

Unit II:

Signal Generation and Analysis Signal generators, Function generators. Wave analyzer Harmonic Distortion Analyzers, Spectrum Analysis.

Unit III:

Signal Counting and Recording Decade counting Assembly, Binary counter, Decimal counter, Decade counter with digital display, universal counter, Digital readout devices, storage type CRO, Servo type X-Y recorder.

Unit IV:

Signal conditioning and Conversions. Frequency characteristics of various types of signals, active filters bandpass, low pass and high pass filters using opAmps. Various techniques of A/D and D/A conversions. Modulation and demodulation PCM techniques, phase locked loop. DRAFT

Unit V:

Signal Processing Pulse times, triggered delayed sweeps, discrete pulse delay circuits, pulse sequencing, analog multiplexers and de-multiplexers, digital multiplexing sample and hold circuits, serial and parallel digital data conversion. Signal transmission, Analog and digital telemetry techniques, MODEM and UART, keyboard and character generators, tape recorder,

Unit VI:

Introduction to Processor and Processor based Techniques. Introduction to PLC, PLC architecture, programming; ladder diagram and examples, micro controller-based instrumentation

Text Books:

1. H.S. Kalsi – Electronic Instrumentation, - Tata Mc-Graw Hill Publishing Company, New Delhi.

2. Cooper, Helfrick – Electronic Instrumentation and Measurement Techniques, A Prentice Hall of India. New Delhi.

Reference Books:

1. B.R. Gupta-Electronics and Instrumentation – Wheeler Publishing.

2. Rangan, Sharma & Mani – "Instrumentation – devices & Systems." Tata Mc-Graw Hill Publishing Company, New Delhi.

3. R.P. Jain-Digital Electronics, Tata Mc-Graw Hill Publishing Company, New Delhi.

4. Microprocessors and Digital Systems, by: D. V. Hall, TMH Publishing Company, New Delhi.

5. Shoen Beck- Electronic Communication, Prentice Hall of India. Pvt. Ltd. New Delhi.

6. B. Ram- fundamental of Microprocessors, Dhanpat Rai & Sons, New Delhi.

7. A.K. Sawhney – A Course in Electrical & Electronics Instrumentation, Dhanpat Rai & Sons, New Delhi.

5EP224PC Electronics Components & Circuits Lab

Conduct minimum eight experiments based on the syllabus of Electronics Components & Circuits (5EP220PC)

5EP225PC/5EE225PC Electrical Machines - II Lab

Conduct minimum eight experiments based on the syllabus of Electrical Machines - II (5EP221PC/5EE221PC)

5EP226PC/5EE226PC Power System - I Lab

Conduct minimum eight experiments based on the syllabus of Power System – I (5EP222PC/5EE222PC)

Multi-Disciplinary Minor (MDM)

5EP227MD/5EE227MD - DC Machines

Course Outcomes:

After Completing this course student will be able to

1. Explain the construction, principle of operation, EMF equation and torque equation of DC machines.
2. CO2: Classify the types of DC generators with their circuit diagrams, characteristics, and applications, including parallel operation.
3. CO3: Describe characteristics, applications, starting methods and speed control methods of various types of DC motors.

Unit I: D.C. Machines:

Construction - Yoke, Armature, Field Poles, Field Coils, Cummutator, Brushes used for Construction – Martial Used for Construction, Principle of Operation, EMF Equation, Torque Equation. Armature winding – Lap, wave, single layer, double layer. Commutation, Process of commutation

Unit II : D.C. Generators:

Types DC Generator & Their Circuit Diagram with Current, Voltage Power Equation, Open Circuit, Internal & External Characteristics of Self Excited and Separately Excited DC Generator, Applications of D. C. Generators, Parallel Operation of D.C. Generators.

Unit III : D.C. Motors:

Principle of DC Motor, Back EMF, Types- Permanent Magnet, Separately Excited Characteristics, Self Excited DC Motor, Applications of D.C. Motors. Need of Starter- Three Point Starter & four Point Starter, Speed Control of DC Motors- Field Control, Armature Control and Voltage Control Method.

Text Book:

Electrical Machines by D P Kothari & I J Nagrath Published by Tata McGraw-Hill Book Comp. New Delhi.

Reference Books:

1) C. Dawes: Electrical Engineering, Vol.I: Direct current (IV Edition), (McGraw Hill Book Company)

2) H. Cotton: Advance Electrical Technology, (Wheeler publication)

Multi-Disciplinary Minor (MDM)

5EP228MD/5EE228MD - AC Machines

Course Outcomes:

After Completing this course student will be able to

1. Explain single-phase induction motor construction, operation, types, characteristics, and applications.
2. Demonstrate the construction, operation, characteristics, applications, starting methods and speed control methods of three-phase induction motors.
3. Summarize construction, operation, and applications of special motors like BLDC motor, universal motor, stepper motor, PMSM, SRM.

Unit I: Single-Phase Induction Motors

Construction- Stator & Rotor, Working Principle, Double Revolving Theory, Classification - Split-Phase Motors, Capacitor Motors, Shaded Pole Motors of single-phase induction motors, Characteristics and applications.

Unit II: Three-Phase Induction Motors

Construction, Working Principle, characteristics of 3 phase Induction motors, applications. Starting, Speed Control Method- Supply voltage control, Supply frequency control (V/f control using VFD), Pole changing method, Rotor resistance control, Slip power recovery methods

Unit III: Special Motors

Constructional details, working and applications of universal motor, SRM motor, brushless DC motors, stepper motors, servo Motor, permanent magnet synchronous motor

Text Books:

1. D. P. Kothari & I. J. Nagrath, "Electrical Machines"- 5thEdition, TMH Publication.

Reference Books:

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. C L Dawes, "A Course in Electrical Engineering (Volume -2)", McGraw Hill Publication

5EP229MD Electrical Machines Lab

Conduct minimum eight experiments based on the syllabus of DC Machines (5EP227MD) & AC Machines (5EP228MD**)**

Open Elective III

5EP230OE1/5EE230OE1 - Energy Audit and Management

Course Outcomes:

After completing this course student will be able to:

1. Summarize energy scenario, its management and the energy audit procedures.

2. Determine the economics of energy conservation.

3. Discuss various energy Conservation methods & energy audit case studies.

Unit I:

Energy Scenario & Management: Indian energy scenario, India Energy sector reforms, various forms of energy, Energy and environment, Energy strategy for the future, Concept of supply side management and demand side management.

Energy Audit: Definition, Need of energy audit, Preliminary and detailed energy audit. Procedure for carrying out energy audit, Instruments used for energy audit, Sankey diagram, Recommendations for energy conservation, Action plan, Executive Summary.

Unit II:

Economics of energy conservation: Cost factors, Budgeting, Standard costing and Sources of capital, Cash flow diagram and activity chart, Simple Payback period analysis, Time value of money, Net present value method, internal rate of return method, Profitability index for benefit cost ratio.

Unit III:

Energy Conservation: Energy conservation in motive power, Illumination, Heating & cooling systems, Pumping systems.

Energy Audit Case Studies: Energy Intensive Industries, Commercial, Municipal and Hospitals.

Text Book:

Guide books for National Certification Examination for Energy Manager / Energy

Auditors Book-1, Book-2, Book-3, Book-4 (available online BEE website)

Reference Books:

1. S. C. Tripathy, “Utilization of Electrical Energy and Conservation”, McGraw Hill, 1991.

2. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

3. Energy Conservation and Audit by Thumman, Fairmont Press

4. Energy Audit and Conservation TERI

5EP230OE2/5EE230OE2 - Electrical Estimation and Costing

Course Outcomes:

After completion of the course students will be able to

1. Explain the fundamentals of electrical installations and service connections.
2. Prepare detailed estimates and costing for residential, commercial, and small industrial electrical installations.
3. Analyze distribution systems and tendering procedures for execution of electrical works.

Unit I: Electrical Installation and Service Connection

Classification and general requirements of electrical installations. Important definitions related to installation work. Concept, types, features, and methods of service connections. Basic estimation of service connections.

Unit II: Electrification and Estimation of Installations

Design and estimation of residential, commercial, and small industrial installations including load assessment, circuit planning, motor wiring concepts, and selection of wiring systems, cables, and bus bars. Earthing methods for electrical installations. Preparation of detailed estimates and costing for buildings and factory units.

Unit III: Distribution Systems, Substations and Contract Procedures

Design and estimation of feeders, distributors, and distribution substations (indoor and outdoor), including selection of transformer size and location. Tender procedures, contract conditions, comparative statements, administrative approval, technical sanction, execution of works, and billing of completed projects.

Text & Reference Books:

1. Electrical Design; Estimating and costing by K.B. Raina, S. K. Bhattacharya New Age International Pvt Limited, New Delhi.

2. Electrical Estimating and costing by Surjit Singh Dhanpat Rai and company, New Delhi

3. Electrical Estimating and costing by N. Alagappan S. Ekambaram, Tata Mc Graw Hill Publication New Delhi

4EE209PC/4EP209PC- Electrical Machine – I

Course Outcomes:

After Completion of this course, students will be able to:

1. **Explain** the Construction, working operation, of DC Machines.
2. **Illustrate** the different Characteristics, types, their Application and Parallel Operation of DC Generator.
3. **Demonstrate** the various types of DC motor, characteristics, starting method, testing method, speed control method and braking operation on DC motors.
4. **Explain** the Construction, working, types of Single-Phase Transformer and testing of Single-phase transformer.
5. **Explain** the Construction, working, different connections, applications and testing of three phase transformers.

Syllabus

Unit I: D.C. Machines:

Construction, Principle of Operation, EMF Equation, Torque Equation. Armature winding – Lap, wave, single layer, double layer. Armature Reaction and commutation, method of improving commutation.

Unit II: D.C. Generators:

Types- Separately & Self Excited generator, Characteristics- OCC, internal & External, Applications of D. C. Generators, Parallel Operation of Series, Shunt & Compound D.C. Generators, testing of DC Generators.

Unit III: D.C. Motors:

Types- Series, Shunt & Compound Motor, Characteristics of DC Motor, Applications of D.C. motors. Starting, Electric Braking, Speed Control of DC Motors. testing of DC Motors, Losses, efficiency.

Unit IV: Single phase Transformer:

Working Operation, EMF Equation, and separation of core losses, Equivalent Circuit, Phasor diagram, Parallel Operation. Open Circuit, Short Circuit & Sumpner's test on single phase transformer.

Single phase Autotransformer: - construction, working, merits, demerits and its application.

Unit V: Three Phase Transformer:

Construction, Working, Types, connections, vector groups, open delta Connection, Open Circuit test, Short Circuit test, load test, magnetic balance test.

Unit VI:
On load & Off load tap changers, Scott Connection, Power transformer and Distribution transformer. Three-winding transformer, Magnetising inrush current phenomenon.

Books Recommended:

Text Books:
1) Nagrath & Kothari: Electrical Machines, (Tata McGraw-Hill Book Comp. Delhi.)
2) J. B Gupta: Theory Electrical machines, (Katria Publication)

Reference Books:
1) C. Dawes: Electrical Engineering Vol. I : Direct current (IV Edition), McGraw Hill Book Company
2) P. S. Bimbhra: Electrical Machinary, Khanna Publisher
3) Clayton and Hancok: Performance and design of d.c. machines

4EE210PC/4EP210PC - Control System

Course Outcomes:

After completing this course, student will be able to:

1. Demonstrate the fundamental concepts of automatic Control and mathematical modeling of the Systems.
2. Analyze the transfer functions, Signal flow graphs and feedback system for stability and noise reduction.
3. Examine the functionality and applications of various control system components like motors and encoders.
4. Analyze time response characteristics of first and second order system with error analysis.
5. Apply stability criteria using Routh-Hurwitz and frequency response methods.
6. Assess system stability through Bode plots, Nyquist plots and gain/phase margin analysis.

Syllabus:

Unit I: Introduction to Automatic Control

Open loop and closed loop system, servo-mechanisms, mathematical modeling of physical systems, transfer functions, block diagrams and signal flow graphs, Effect of feedback on sensitivity to parameter variation and reduction of the noise.

Unit II: Control System Components

Electrical / Electro-mechanical components such as A.C./D.C. servomotors, stepper motors, Synchors, potentiometers, Tacho-generators, encoders, their functional analysis and operating characteristics and their application.

Unit III: Time Response Analysis

Time response of first and second order systems to standard inputs. Time response specifications, types of system, error analysis, error coefficients, steady state errors, dynamic error series. Approximate methods for higher order system, proportional, derivative and integral control.

Unit IV: Stability

Stability of control systems, characteristics equation, impulse response, Routh-Hurwitz stability criterion, relative stability. Root Locus: construction of root locus, determination of roots from root locus conditions on variable parameter for stability, effect of addition of poles and zeros.

Unit V: Frequency Response Analysis

Frequency response of linear system, specification, Logarithmic frequency response (Bode) plots from transfer function for various systems. Polar plots for various systems, Nyquist criterion, Nyquist plots and stability analysis.

Unit VI: State Variable Analysis

Space model representation of LTI systems using physical system, Relationship between state variable model and transfer function, Solution of state equations.

Books Recommended:

Text Book:

1. Nagrath I.J., Gopal M.: Control System Engineering, Wiley Eastern.

Reference Books:

1. Control Engineering, D.Ganesh Rao, k. Chennavenkatesh, 2010, PEARSON
2. Modern Control System, Richard Dorf, Robert Bishop, 11th edition 2008 PEARSON
3. Ogata K: Modern Control Systems, Prentice Hall of India.
4. Control Systems by K.R.Varmah TMH edition 2010
5. Control System Engineering, R Ananda Natarajan, P Ramesh Babu, SCITECH Publications, Chennai, 2nd edition,2010
6. Automatic Control Systems – Basic Analysis &DesignbyW.A.Wolovich Oxford University Press, 1st edition 2010
7. Linear Control Systems, Ashfaq Hussain, Haroon Ashfaq, Dhanpat Rai & co.

4EE211PC/4EP211PC - Electromagnetic Fields

Course outcomes:

At the end of the course the student will be able to:

1. Demonstrate the basic mathematical concepts related to electromagnetic vector fields.
2. Apply the principles of electrostatics to the solutions of problems relating to electric field a
3. Apply the principles of magneto statics to the solutions of problems relating to magnetic field.
4. Apply Maxwell's equation in different forms (differential and integral) to diverse engineering problems.

Syllabus:

Unit I:

Review of Vector Analysis: Cartesian, cylindrical and spherical co-ordinate systems, vector algebra and vector calculus. Line integral and multiple integrals. Gauss theorem.

Unit II:

Electrostatics: Coulomb's law, electric field, Gauss flux theorem in integral and differential form. Electrostatics potential, Poison and Laplace equations.

Unit III:

Electrostatics fields in dielectrics: electric dipole, polarization. P and D vectors, boundary conditions. Capacitance and electrical energy.

Unit IV:

Magnetic fields: Biot-Savart law, Ampere's law in integral and differential form. Continuity equation, time of relaxation. electric current, J vector.

Unit V:

Magnetic fields in materials: magnetic dipole boundary conditions between magnetic materials, inductance, Electromagnetic Energy.

Unit VI:

Maxwell equations and wave equations: Displacement current, time varying fields and Maxwell's equations, plane uniform magnetic waves. Depth of penetration Poynting vector

Text Book:

1. **“**Engineering Electromagnetics”, by Hayt W.H. Tata Mc-Graw Hill publication

Reference Books:

1. Electromagnetic fields by TVS Arun Murthy S Chand & Co
2. Principles and applications of Electromagnetic fields by Plansycollin, Mc-Graw Hill Books Co.
3. Foundations of electromagnetic theory by John Reitz, Addison Wesley Pub Co.
4. Basic electromagnetic field by Herbert Neelf, Harber International education
5. Introduction to electromagnetic, Derucy and Johnson, Mc-Graw Hill Books Co.

4EE212PC/4EP212PC – Electrical Machine-I Lab

Conduct minimum eight experiments based on the syllabus of Electrical Machine – I subject (4EP209PC)

4EE213PC/4EP213PC – Control System Lab

Conduct minimum eight experiments based on the syllabus of Control System subject (4EP210PC)

4EE214MD/4EP214MD - Electrical Measurements

Course Outcomes:

A student completing this course, should be able to:

1. Classify the various measuring instruments like PMMC, MI, Electrodynamic type.
2. Explain the measurement of power and energy by wattmeter and energy meter.
3. Analyze various methods for measurement of resistance, inductance, and capacitance using AC/DC bridges.

Syllabus

Unit-I: Analog Instruments - Classification of measuring instrument, Different torques in measuring instrument, Construction, theory of operation, torque equation, errors, merits and demerits of analog Ammeter, Voltmeter (PMMC, MI instruments) and Electrodynamic type meter.

Unit II: Wattmeter and Energy Meter-Construction, theory of operation, torque equation, errors, merits and demerits of each type.

Analysis of three phase balanced load: - Blondell's theorem, Measurement of active and reactive power in single phase and three phase circuits.

Unit III: Measurement of circuit parameters- Different methods of measurement of inductance, capacitance and low, medium, high value of resistance,

Instrument transformers- C.T. and P.T., Importance, theory and construction and applications.

Text Book:

1. A.K. Sawhney, 'Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai& Co (P) Ltd

Reference Books:

1. E. W. Golding & F. C. Widdis, 'Electrical Measurements & Measuring Instruments', A. H. Wheeler & Co.
2. Electrical Measurements and Measuring Instruments. By, R. K. Rajput. Publisher, S. Chand,

4EE215VS/4EP215VS – Electrical Software Lab

Develop minimum eight computer programme / Simulation models for various tasks in electrical engineering domain using any open source/professional software.

4EE216OE1/4EP216OE1: Electrical Drives

Course Outcomes:

After completing this course, Students will be able to:

1. Explain the basic of electrical drives and Power Electronics devices
2. Demonstrate various modern speed control techniques of DC drives
3. Demonstrate various modern speed control techniques of AC drives

Syllabus:

Unit I:

Fundamentals of electric drives: Definition, block diagram, types of electrical drives, duty cycle, selection criterion for electrical drives. Theory, principle and characteristics of Power Transistor, SCR, Power MOSFET and IGBT.

Unit II:

DC Motor & Drive: Types, construction, principle of working, characteristics. Speed control: Armature voltage and field current control methods.

Unit III:

AC Motor & Drive: Three phase Induction Motors: Types, construction, principle of working, torque-speed characteristics. Power Electronics based Speed Control of three phase induction motor i) Stator side control of three phase squirrel cage Induction Motor ii) Rotor side control of three phase slip ring Induction Motor

Text Books:

1. S. K. Pillai: A First Course on Electrical Drives by New Age International Publishing Co. Ltd
2. Vedam Subrahmanyam: Electric Drives: Concepts & Applications by Tata Mc Graw Hill Publishing Co Ltd.

Reference Books:

1. I.J. Nagrath & D. P. Kothari: Electric Machines by Tata Mc Graw Hill Publishing Co Ltd.
2. V. K. Mehta: Principles of Electronics by S. Chand and Co Ltd, New Delhi
3. M. D. Singh & K. B. Khanchandani: Power Electronics by Tata Mc Graw Hill Publishing Co Ltd
4. Austin Hughes and Bill Drury: Electric Motor and Drives: Fundamentals, Types and Applications by Newness, Oxford.
5. Gopal. K. Dubey: Fundamentals of Electrical Drives by CRC Press
6. R. Krishnan: Electric Motor Drives: Modelling, Analysis & Control by Prentice Hall of India Pvt Ltd.

4EE216OE2/4EP216OE2: ELECTRICAL MACHINES

Course Outcomes:

After Successful completion of this course, Students will be able to:

1. Demonstrate their knowledge of construction, working, types, characteristics, starters, and speed control method of DC motor.
2. Describe the construction, working operation, performance characteristics, starters, speed control & application of three phase Induction Motor.
3. Explain the construction, working operation & performance characteristics of single-phase Induction Motor and special motors like universal motor, BLDC Motor.

Syllabus

Unit I: DC Motor:

Construction, Principle of Operation, Torque Equation, Types- Series, Shunt & Compound Motor, Characteristics of DC Motor, Starters for DC Motor, Speed Control of DC Motor. Applications of D.C. motors.

Unit II: Three phase Induction Motor:

Construction, Working, Torque equation, Torque Slip Characteristics, Starters for IM, Methods of speed control, single phasing phenomenon. Applications.

Unit III: Single phase Induction Motor:

Double revolving field theory, Constructional features, working, Split-phase starting methods Torque Speed Characteristics and applications of single-phase Induction motors.

Special Motors: Construction, working principle, and applications of Universal motor, & Brushless DC (BLDC) Motor.

Text Books:

1. I.J. Nagrath & D. P. Kothari: Electric Machines by Tata Mc Graw Hill Publishing Co Ltd.
2. J. B. Gupta: Theory of Electrical Machines, published by S. K. Kataria & Sons, Delhi.

Reference Books:

1. P. S. Bimbhra: Electrical Machinery, published by Khanna Publisher Delhi
2. C. Dawes: Electrical Engineering Vol. I: Direct current (IV Edition), (McGraw Hill Book Company)
3. A. S. Langdorf, “Theory of Alternating Current Machinery” Tata McGraw Hill Publication New Delhi.

4EE217EM/4EP217EM - Engineering Economics

Course Outcomes –

After successful completion of the course, students will be able to -

1. Apply the concepts economics to assess demand and, including elasticity and laws of returns.
2. Demonstrate the understanding of cost and revenue structures, market types and inflationary trends, and banking principles.
3. Make use of the principles of time value of money, economic equivalence, and depreciation to evaluate engineering projects through various methods.

Syllabus:

Unit I:

Engineering Economics- Nature, Scope, Basic problems of an economy, Micro Economics and Macro Economics.

Demand- Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Elasticity of demand & its measurement,

Supply-Meaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, Determination of market equilibrium.

Production-Production function, Laws of returns: Law of variable proportion, Law of returns to scale.

Unit II:

Cost and revenue concepts, Basic understanding of different market structures, Determination of equilibrium price under perfect competition, Break Even Analysis-linear approach.

Banking -Commercial bank, Functions of commercial bank, Central bank, Functions of Central Bank.

Inflation-Meaning of inflation, types, causes, measures to control inflation.

National Income-Definition, Concepts of national income, Method of measuring national income.

Unit III:

Time value of money- Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.

Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects.

Depreciation- Depreciation of capital assert, Causes of depreciation, Methods of calculating depreciation (Straight line method, Declining balance method).

Text Books:

1. Elementary Economic Theory by Dewett and Varma J.D., S. Chand and Co
2. Engineering Economics by R.Paneer Seelvan, PHI

Reference Books:

1. Principles of Economics, Deviga Vengedasalam; Karunagaran Madhavan, Oxford University Press.
2. Principles of Micro Economics by Ahuja,H.L., S.Chand and Co
3. Macro Economics by S.P.Gupta, TMH
4. Engineering Economics by Riggs, Bedworth and Randhwa, McGraw Hill Education India
5. Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson