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, Tellegen's 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,

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

3EE400EL/3EP400EL - Community Engagement Project/ Field project (Related to Major)

Course Objectives:

Students shall undertake and execute a Project through a group of students to:

1. Understand the complete project development cycle and apply it in the context of electrical systems.
2. Gain practical experience through field work and hands-on implementation related to power systems, renewable energy, and agriculture-based electrical applications.
3. Build competency in problem-solving, project documentation, and technical communication.
4. Engage with real-world community issues and offer sustainable and technically sound solutions.

Course Outcomes:

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

1. Apply foundational knowledge in electrical engineering to solve practical and community-related problems.
2. Analyze electrical systems relevant to societal and agricultural needs.
3. Work effectively as part of a team and communicate technical information through structured reports.
4. Conduct field surveys, evaluate electrical challenges, and propose feasible and sustainable solutions.

Minor Project Work:

Group Size: Minimum 4 and maximum 10 students per group.

Project Type:

The selected mini project should be based on any of the following:

- Survey and evaluation of schemes related to rural electrification or renewable energy.
- Design of Solar installations
- Energy auditing and conservation strategies in residential, industrialand institutional setups.
- Investigation of performance of solar inverters, battery systems, or smart metering.
- Design of low-cost electrical training kits or laboratory aids.
- Study of power quality issues or losses in local power distribution.
- Design and development of **electrically powered smart agricultural tools or systems.**

General Guidelines:

Project domains may include (but are not limited to):

- Power Distribution Systems and Loss Reduction
- Renewable Energy Applications
- Agri-Electrical Mechanization
- Electrical Safety Systems
- Automation using Arduino/IoT in Electrical Applications
- Energy Conservation
- Green Energy Initiatives
- Power Quality Improvement

Project Report:

A project report with the following contents shall be prepared:

1. Title, Certificate and Index
2. Objectives
3. Introduction
4. Problem Identification
5. Methodology - Experimental Method / Data Collection and Analysis / Case Study / Survey Method / Research Method
6. Analysis - Graphical Representation / Simulation / Experimentation / Survey / Testing, etc.
7. Probable Solution
8. Conclusion
9. References

3EE203PC/3EP203PC - Electrical Circuit Analysis Lab

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

3EE204PC/3EP204PC - Electrical Measurement and Instrumentation Lab

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

3EE205MD/3EP205MD - 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.

3EE206OE1/3EP206OE1 - 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 conductorsin 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

3EE206OE2/ 3EP206OE2Energy Generation and Utilization

Course Outcomes

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

1. Explain the working of Thermal, Hydro & Nuclear power plants.
2. Explain the working of Solar & Wind energy conversion systems.
3. Select proper electrical drive for industrial applications.
4. Demonstrate the knowledge of electric traction system.
5. Describe an illumination system.

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: Boiler, turbine, Alternator, Economizer, air preheater, condenser, cooling tower, ash & coal handling plant.

Unit II:

Hydro power plant:

Layout of Hydro power plant, site selection, 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.

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.

Unit IV: Electrical Drives:

Concept of Electrical drives: Block diagram, types of motors. Factors for selection of electrical drive. Industrial applications: Textile mill, Cement mill, Sugar mill.

Unit V: Traction System:
Requirement, speed- time curves. General features, types, Different accessories for track electrification –overhead wires, conductor rail system, current collector-pantograph.

Unit VI: Illumination:
Street lighting: Principle, illumination level, mounting height of lamps, spacing, types of lamps. Flood lighting: Flood lighting calculations, waste light factor, Depreciation factor, Utilization factor.
Design of Illumination system for domestic and commercial Applications. LED : Working principle, advantages & applications.

Books Recommended:

Text Book:

1. Generation of electrical energy by B. R. Gupta, Eurasia Publishing House, New Delhi
2. S.K.Pillai, "A First Course on Electrical Drives", New Age International Publication.
3. Utilization of Electric Power & Electric Traction by J.B.Gupta , S.K.Kataria & Sons, 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.
6. Electric Traction by J.Upadhyay & S.N.Mahendra , Allied Publishers Ltd
7. Art & Science of Utilization of Electrical Energy by H.Pratap , Dhanpat Rai & Company Ltd.
8. Modern Electric Traction by H Pratap, Dhanpat Rai & Sons Ltd

3EE207EM/3EP207EM -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)