Teaching and Evaluation Scheme for TY B. Tech

Department of Electrical Engineering

Semester: V

TECHNOLOGY COLLEGE OF ENGINEERING ELECTRICAL DEPT YADRAV

Head of the Department
Electrical Engineering
HARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Department: Electrical Engineering **Rev:** Course Structure/00/2023-24

Class: T.Y. B.Tech **Semester:** V

Course Code	Type of Course	Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	P	Total Hrs	CA1	CA2	MSE	ESE	Total	
23EE3501	PCC	Power Electronics	3	-	-	3	10	10	30	50	100	3
23EE3502	PCC	Power System Stability and Control	3	-	-	3	10	10	30	50	100	3
23EE3503	PCC	Electrical Machine Design	3	-	-	3	10	10	30	50	100	3
23EE3504	PEC	Program Elective Course- I	3	-	-	3	10	10	30	50	100	3
23EE3505	PCC	Power Electronics Laboratory	-	-	2	2	15	15	-	20	50	1
23EE3506	PCC	Industrial Automation Laboratory	-	-	2	2	15	15	-	20	50	1
23EE3507	PCC	Electrical Machine Design Laboratory	-	-	2	2	25	25	-	-	50	1
23EE3508	CEP	Mini Project-IV	-	-	2	2	25	25	-	-	50	Audit
23EEMDX3	MDM	**Multidisciplinary Minor-III**	3	-	-	3	10	10	30	50	100	3
23OEEE33	OEC	**Open Elective Course-III**	3	-	-	3	10	10	30	50	100	3
23HSSM05	VEC	Aptitude Skills-III	1	-	-	1	25	25	-	-	50	Audit
23HSSM06	VEC	Language Skills-III	-	-	2	2	25	25	-	-	50	Audit
23EE3509	CEP	Industrial Training	-	-	-	-	-	-	-	50	50	Audit
Total			**19**	**-**	**10**	**29**	**190**	**190**	**180**	**390**	**950**	**21**

Multidisciplinary Minor -III

Electrical System Design **(Basket - A)**	Automation and IOT **(Basket - B)**	Renewable Energy Sources and Grid Integration **(Basket - C)**
Lighting System Design(23EEMDA3)	Industrial Automation(23EEMDB3)	Smart Grid(23EEMDC3)

Program Elective Course-I

A	Energy Audit and Conservation
B	Industrial Safety
C	Signals and Systems
D	Optimization Techniques

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Power Electronics

23EE3501	PCC	Power Electronics	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA1: 10 Marks CA2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basic Electrical Engineering; Basic Electronics Engineering
Course Outcomes: At the end of the course, students will be able to:

CO1	Analyze power semiconductor devices, including diodes, rectifiers, MOSFETs, BJTs, and IGBTs, emphasizing their characteristics, switching operations, and applications in power electronics.
CO2	Develop single-phase and three-phase controlled rectifier circuits for various load conditions.
CO3	Evaluate thyristor characteristics, their models, and operational mechanisms, including protection techniques such as di/dt and dv/dt, along with firing circuits and triggering methods like DIACs and UJTs.
CO4	Demonstrate the ability to analyze and operate DC-DC converters (choppers) and DC-AC converters (inverters), emphasizing bridge configurations, harmonic reduction, and current source inverters
CO5	Apply the principles of phase control and integral cycle control to single-phase and three-phase full-wave controllers for resistive and inductive loads.
CO6	Analyze cycloconverter operations, including single-phase, three-phase, and load-commutated configurations, with emphasis on output voltage equations and harmonic reduction techniques.

Course Contents:

Unit 1: Power Semiconductor Devices Power Diodes: Introduction, Diode Characteristics, Reverse Recovery Characteristics, Power Diode Types, Silicon Carbide Diodes, Silicon Carbide Schottky Diodes, Freewheeling diodes, Freewheeling diodes with RL load. Diode Rectifiers: Introduction, Diode Circuits with DC Source connected to R and RL load, Single-Phase Full-Wave Rectifiers with R load, Single-Phase Full-Wave Rectifier with RL Load. Power Transistors: Introduction, Power MOSFETs – Steady-State Characteristics, Switching Characteristics Bipolar Junction Transistors – Steady-State Characteristics, Switching Characteristics, Switching Limits, IGBTs, MOSFET Gate Drive, BJT Base Drive, Isolation of Gate and Base Drives, Pulse transformers and Opto-couplers	[6]
Unit 2: Phase Controlled Rectifiers Controlled Rectifiers: Introduction, Single phase half-wave circuit with RL Load, Single phase half-wave circuit with RL Load and Freewheeling Diode, Single phase half-wave	[6]

circuit with RLE Load, Single-Phase Full Converters with RLE Load, Single-Phase Dual Converters, Principle of operation of Three- Phase duel Converters.	
Unit 3 : Thyristors Thyristors: Introduction, Thyristor Characteristics, Two-Transistor Model of Thyristor, Thyristor Turn-On, Thyristor Turn-Off, A brief study on Thyristor Types, Series Operation of Thyristors, Parallel Operation of Thyristors, di/dtProtection, dv/dtProtection, DIACs, Thyristor Firing Circuits, Unijunction Transistor..	[6]
Unit 4 : Choppers and Inverters DC-DC Converters: Introduction, the principle of a step-down and step-up chopper with RL load, performance parameters, DC-DC converter classification. DC-AC Converters: Introduction, the principle of operation single-phase bridge inverters, three-phase bridge inverters, voltage control of single-phase inverters, Harmonic reductions, Current source inverters.	[6]
Unit 5: AC Voltage Controllers Introduction, Principle of phase control and Integral cycle control, Single-Phase Full-Wave Controllers with Resistive Loads, Single- Phase Full-Wave Controllers with Inductive Loads, Three-Phase Full-Wave Controllers.	[6]
Unit 6 : Cycloconverters Introduction; Basic Principle; Single to single-phase cycloconverters; Three-phase half-wave cycloconverters; Cycloconverters for three phase output; Output voltage equation; Output harmonics in cycloconverter; Comparison between cycloconverter and DC link Converter; Load Commutated cycloconverter	[6]

Textbooks:

1. Mohammad H Rashid, Power Electronics: Circuits Devices and Applications, Pearson 4th Edition, 2014.

Reference Books:

1. P.S. Bimbhra, Power Electronics, Khanna Publishers, 5th Edition, 2012
2. Ned Mohan et al, Power Electronics: Converters, Applications and Design, Wiley 3rd Edition, 2014.
3. Daniel W Hart, Power Electronics, McGraw Hill 1st Edition, 2011.
4. Philip T Krein, Elements of Power Electronics, Oxford Indian Edition, 2008.

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Power System Stability and Control

23EE3502		PCC	Power System Stability and Control	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA1: 10 Marks CA2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Power System Analysis, AC Machines
Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the fundamental concepts of power system stability, including rotor angle stability, voltage stability, and frequency stability.
CO2	Evaluate load flow methods, including Gauss-Seidel and Newton-Raphson techniques, to solve power flow equations and optimize system operations
CO3	Apply the principles of symmetrical components and sequence networks to calculate sequence impedances and construct power system models.
CO4	Examine fault analysis techniques for symmetrical and unsymmetrical faults using sequence voltages, bus impedance matrices, and general procedures.
CO5	Explain the concept of voltage stability and voltage collapse in power systems and voltage stability improvement techniques.
CO6	Analyze frequency stability under various conditions, incorporating inertia dynamics, governor response, AGC, and the impact of renewable energy.

Course Contents:

Unit 1: Introduction to Power System Stability Basic concepts and definitions, Types of Stability:Rotor Angle Stability, Voltage Stability, Frequency Stability, Classification: Steady State, Transient, and Dynamic Stability, Power angle curve, An elementary view of transient stability ,swing equation ,M and H constant, Equal Area Criterion and its applications, critical clearing angle, Rotor angle stability, Importance of Power System Stability, Factors Affecting Power System Stability.	[6]
Unit 2: Power Flow Analysis Bus classification, Bus admittance matrix, General form of power flow equations, Gauss-Seidel and Newton-Raphson methods, Comparison of load flow methods	[6]
Unit 3: Symmetrical Components Symmetrical components, Dr. Fortescue Theorem, Component synthesis, Component analysis, Sequence impedances and Sequence networks, Sequence impedances of transmission lines, transformers, and synchronous machines, Construction of sequence network of a power system.	[6]
Unit 4: Symmetrical and Unsymmetrical Faults Symmetrical Faults: Classification, Effect of faults, Balanced three phase fault, Short	[8]

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circuit capacity, Symmetric fault analysis using bus impedance matrix. Unsymmetrical Faults: Assumptions, Sequence voltages of generator, General procedure for analysis of various faults, Analysis of unsymmetrical faults.	
Unit 5: Voltage Stability Concept of Voltage Stability and Voltage Collapse, Classification of Voltage Stability: Short Term and Long Term Voltage Stability, Factors Affecting Voltage Stability, Voltage Stability Improvement Techniques.	[6]
Unit 6: Frequency Stability Concept of Frequency Stability, Inertia and Frequency Dynamics, Primary Frequency, Control: Governor Response, Secondary Frequency Control: Automatic Generation Control (AGC), Impact of Renewable Energy on Frequency Stability, Frequency Stability under Islanding Conditions.	[6]

Textbooks:

1. I.J. Nagrath and D.P. Kothari, Power System Analysis, TMH Publication
2. Hadi Saadat, Power System Analysis, TMH.
3. B.S.R. Murty, Power System Analysis, B.S. Publications.

Reference Books:

1. Glover, Sharma, Overbye, Thompson, Power Systems Analysis and Design, 5th Edition, Cengage Learning, 2012.
2. Stevenson W.D., Elements of Power System Analysis, TMH.
3. Prabha Kundur, Power System Stability and Control, McGraw Hill Professional, 2022.

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Electrical Machine Design

23EE3503		PCC	Electrical Machine Design	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA1: 10 Marks CA2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: DC Machine and Transformers, AC Machines
Course Outcomes: At the end of the course, students will be able to:

CO1	Analyze the ratio of iron loss to copper loss and its impact on efficiency.
CO2	Solve for no-load current, equivalent circuit parameters, and performance characteristics of transformers.
CO3	Determine the main dimensions, winding configurations, and stator slot design for efficiency improvement.
CO4	Analyze the operating characteristics of three-phase induction motors, including no-load current, magnetizing current, short-circuit current, and performance parameters obtained using the circle diagram, to evaluate static torque, maximum torque, output, power factor.
CO5	Determine diameter and length using output equations and analyze the effect of short circuit ratio on performance.
CO6	Analyze machine designs as per Indian Standards (IS) and international testing methodologies.

Course Contents:

Unit 1: Constructional Details And Design of Transformers Output equation, EMF per turn. Ratio of iron loss to copper loss, Relation between core area and weights of iron and copper, optimum designs, Core design. Design of windings.	[6]
Unit 2: Performance Evaluation of Transformer Calculation of no-load current. Equivalent circuit and performance characteristics. Temperature rise. Design of tank and radiators.	[6]
Unit 3: Constructional Details And Design of Three Phase Induction Motors Output equation. Specific electric and magnetic loadings. Efficiency and power Factor, main dimensions. Type of winding and connection .Turns per phase, shape of stator slots. Number of stator slots, design of stators.	[7]
Unit 4: Operating Characteristics of Three Phase Induction Motors No load current Magnetizing current, loss component short circuit current. Use of circle diagram to obtain performance figures. Calculation of static torque, maximum torque, maximum output, maximum power factor. Dispersion coefficient.	[7]
Unit 5: Design of Synchronous Machines Construction of water wheel and turbo alternators. Different parts and materials used for	[7]

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Synchronous machine, choice of electric and magnetic loadings, Output equation. Determination of diameter and length, effect of short circuit ratio on machine performance.	
Unit 6: Computer Aided Design of Electrical Machines Benefits of computer in machine design, methods of approach, optimization and computer aided design of induction motor and three phase transformer, Testing as per IS.	[6]
Textbooks: 1. A. K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai and Sons, Delhi. 2. V.N. Mittle and A. Mittle, Design of Electrical Machines, Standard Publications and Distributors, Delhi.	
Reference Books: 1. R. K. Agarwal, Principles of Electrical Machine Design, S. K. Kataria and Sons, Delhi. 2. S.K. Sen, Principles of Electrical Machine Design with Computer Programmes, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.	

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Program Elective Course-I: Energy Audit and Conservation

23EE3504A	PEC	Energy Audit and Conservation	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA1: 10 Marks CA2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Engineering Physics, Basic Electrical Engineering
Course Outcomes: At the end of the course, students will be able to:

CO1	Evaluate global environmental issues and international frameworks like UNFCC, Kyoto Protocol, and COP to assess sustainable development practices.
CO2	Apply energy audit approaches and benchmarking techniques to optimize energy usage and system efficiencies.
CO3	Assess the performance of boilers, pumps, cooling towers, and cogeneration systems to identify energy conservation opportunities.
CO4	Apply strategies for electrical load management, power factor improvement, and the use of energy-efficient technologies to enhance system performance.
CO5	Evaluate financial analysis techniques and performance contracts to support investment decisions and energy conservation initiatives.
CO6	Develop energy conservation projects through planning, implementation, monitoring, and evaluation based on industrial and commercial case studies.

Course Contents:

Unit 1: Global Environmental Concerns: Global Environmental Issues, United Nations Framework Convention on Climate, Change (UNFCC), Kyoto Protocol, Conference of Parties (COP), Clean Development, Mechanism (CDM), Prototype Carbon Fund (PCF), Sustainable Development.	[5]
Unit 2: Energy Management and Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.	[6]
Unit 3:Thermal and Mechanical Systems: Boilers: Types, Combustion in boilers, Performances evaluation- Direct Method and Indirect Method of Boiler Efficiency, Energy conservation opportunities; Pumps and Pumping System: Types, Performance evaluation, Energy conservation opportunities; Cooling Tower: Types and performance evaluation, Energy saving opportunities; Cogeneration: Definition, Need, Application, Advantages, Classification, Saving potentials.	[8]
Unit 4: Electrical Systems: Electricity billing, Electrical load management and maximum demand control, Power	[7]

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factor improvement and its benefit, Selection and location of capacitors, Performance assessment of PF capacitors, Automatic power factor controllers, Energy efficient motors, Soft starters with energy saver, Variable speed drives, Energy efficient transformers, Electronic ballast, Occupancy sensors, Energy efficient lighting controls	
Unit 5:Financial Management: Investment-need, Appraisal and criteria, Financial analysis techniques-Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis; Financing options, Energy performance contracts and role of ESCOs.	[6]
Unit 6: Case Studies Planning, Implementation and monitoring of energy conservation project, Case studies on various Industrial Sectors and Commercial Establishments.	[4]

Textbooks:

1. Anil Kumar, Om Prakash, Prashant Singh Chauhan, Samsher Gautam, Energy Management Conservation and Audits, CRC Press, 2020.
2. Charles M Gottschalk, Industrial Energy Conservation, John Willey and Sons.
3. Paul O Callagham, Energy Management Handbook, Tata Mc Graw Hill.
4. S. Rao and B. Parulekar, Energy Technology, Khanna Publishers.

Reference Books:

1. Wayne C. Turner, Energy Management Handbook, Fairmont Press, Incorporated, 2018.

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Program Elective Course-I: Industrial Safety

23EE3504B	PEC	Industrial Safety	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA1: 10 Marks CA2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Nil

Course Outcomes: At the end of the course, students will be able to:

CO1	Demonstrate an understanding of electrical hazards, including the effects of electric shock, safe practices, and protection techniques such as earthing and earth leakage circuit breakers.
CO2	Apply fire prevention measures by identifying the causes of fire and utilizing various fire extinguishers and fire detection systems effectively.
CO3	Apply the principles of accident prevention to effectively minimize hazards and errors in various environments.
CO4	Develop the ability to administer first aid for various injuries and emergencies, such as electric shocks, chemical burns, suffocation, fractures, and heat strokes.
CO5	Identify the need, classification, and selection of PPE based on specific body parts and hazards in various work environments.
CO6	Apply tailored safety measures for industries such as automobile, cement, chemical, electronics, food, petroleum, and sugar to enhance workplace safety.

Course Contents:

Unit 1: Electrical Hazards and Safety Concept of Electric Shock, Effects of shock on human body, Safe limits of amperages, safe distance from electrical lines, Overload and Short circuit protection, concept and Types of Earthing (Pipe and Plate), Earth Leakage circuit Breaker, Protection against voltage fluctuations, Concept of static electricity, Concept of Step and Touch Potential.	[6]
Unit 2: Fire Hazards Causes of Fire and Remedial Measures, classification of fire and extinguishers, Statutory Provisions, fire prevention and protection systems, Fire Detection and Alarm Systems, Types of Fire Extinguishers-Soda Acid (Water Type) Extinguisher, Foam Extinguisher, CO_2 (Compressed gas) Extinguisher, Dry Chemical Powder	[6]

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(DCP) Extinguisher, Fire Hydrants	
Unit 3:Principles of Accidents Prevention Need For Safety, Reasons For Accident Prevention:- Humanitarian, Economic Or Costs, Social, Productivity, Etc. Definition: Incident, Accident, Injury, Dangerous Occurrences, Unsafe Acts, Unsafe Conditions, Hazards, Error, Oversight, Mistakes Etc. Principles Of Accident Prevention, Unsafe Conditions, Remedies And Responsibilities	[6]
Unit 4: First Aid Need of First aid, Injuries And First Aid at a Glance:- Electric Shock, Eye-Wounds, Chemical Burns of the Eyes, Suffocation, Heart Attack, Bleeding Nose, Bleeding Ear, Infection, Heat stroke etc. Fractures, Foreign Body in the Body Part, Dressing and Bandaging, Electrical Injuries, Artificial Respiration, Burns and Scalds	[6]
Unit 5: Personal Protective Equipment's Need, Selection and Classification of PPE according to the body part and hazards, Head and Hair Protection, Ear Protection, Face and Eye Protection, Hand and Arm Protection, Foot and Leg Protection, Body, Skin and Fall Protection, Training, Maintenance, Precaution and Care of PPE.	[6]
Unit 6: Safety Measures in Industry Safety Measures In :Automobile Industry, Cement Industry, Chemical Industry, Electronics Industry, Food Industry, Glass Industry, Paper Industry, Petroleum Refinery And LPG Bottling Plants, Plastics Industry, Sugar Industry	[6]

Text/Reference Books:

1. Dr. K. U. Mistry, Fundamentals of Industrial Safety and Health, Siddharth Prakashan, Ahmedabad.
2. Ratan Raj Tatiya, Elements of Industrial Hazards, Health, Safety, Environment and Loss Prevention, CRC Press Publication.
3. John Cadick, Mary Capelli-Schellpfeffer, Dennis K. Neitzel, Al Winfield, Electrical Safety Handbook, Mc Graw Hill Publication.
4. R. Craig Schroll, Industrial Fire Protection Handbook, CRC Press Publication.

Program Elective Course-I: Signals and Systems

23EE3504C	PEC	Signals and Systems	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA1: 10 Marks CA2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Engineering Mathematics-I and II, Network Analysis

Course Outcomes: At the end of the course, students will be able to:

CO1	Classify continuous and discrete signals and systems based on characteristics such as linearity, time invariance, causality, stability, and dynamics.
CO2	Analyze the zero-state and zero-input responses, convolution operations, and graphical representation of convolution for continuous and discrete-time systems.
CO3	Analyze periodic and aperiodic signals in the frequency domain using Fourier series and Fourier transforms, emphasizing properties like duality and time reversal.
CO4	Solve differential equations and perform system analysis using Laplace transforms to determine transfer functions, poles, and zeroes.
CO5	Apply Nyquist Sampling Theorem and discrete-time Fourier transform to represent and analyze aperiodic sequences in the time and frequency domains.
CO6	Evaluate discrete time signals and systems using Z-transforms to determine transfer functions, poles, zeroes, and the behaviour of FIR and IIR systems.

Course Contents:

Unit 1 :Introduction to Signals and Systems Continuous and Discrete - Introduction, standard signals, signal, representation, classification of signals, systems – representation, classification, Linear, Time invariant, causal, BIBO stable, Static, dynamic	[8]
Unit 2: Time Domain Analysis of Continuous and Discrete Time Systems Zero state and Zero input response, Impulse response, Convolution and its properties, Convolution integral, Properties of Convolution integral, Convolution sum, Properties of Convolution sum, graphical representation of convolution	[6]
Unit 3:Fourier Domain Analysis of Continuous Time Signal Trigonometric Fourier series, Compact Trigonometric Fourier series, Exponential form, Dirichlet Conditions, Frequency domain representation of periodic signals,	[6]

Fourier Transform representation of aperiodic signals, Properties of CFT duality, time reversal, Convolution – time and frequency domain	
Unit 4Laplace Transform Analysis of Signals and System Definition, Properties, Solution of differential equation. Transfer function, Poles and Zeroes, System analysis using Laplace Transform.	[6]
Unit 5: Fourier Domain Analysis of Discrete Time Signal Representation of CT signals using Samples, Nyquist Sampling Theorem, Discrete time Fourier Transform, Representation of aperiodic sequence, Properties of DTFT: time reversal, Linear Convolution – time and frequency domain, conjugate symmetry.	[6]
Unit 6: Z- Transform Analysis of Discrete Time Signals and Systems Definition, Properties, Solution of difference equation. Transfer function, Poles and Zeroes, System analysis using Z-Transform, FIR, IIR systems.	[6]

Textbooks:

1. A.V. Oppenheim, A.S. Wilsky, S.H. Nawab, Signals and Systems, 2nd Edition, Pearson, 2015.
2. B. P. Lathi, Principles of Linear Systems and Signals, 2nd Edition, Oxford University Press, 2005.
3. A. Anand Kumar, Signals and Systems, 3rd Edition, PHI, 2013.

Reference Books:

1. M. J. Roberts, Signals and Systems, 3rdEdition, Tata McGraw Hill, 2011.
2. Simon Haykin, Barry Van Veen, Signals and Systems, 2ndEdition, Wiley Publications, 2007.

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Program Elective Course-I: Optimization Techniques

23EE3504D	PCC	Optimization Techniques	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA1: 10 Marks CA2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisite: Engineering Mathematics-I and II
Course Outcomes: At the end of the course, the students will be able to:

CO1	Classify optimization problems based on design constraints, objective function characteristics, and design variable properties and also evaluate the physical structure, equations, and deterministic nature of these problems.
CO2	Utilize classical optimization techniques, including the methods of Lagrange multipliers and Kuhn–Tucker conditions, to solve multivariable problems and demonstrate the use of simplex algorithms and duality principles in linear programming.
CO3	Develop effective strategies using advanced linear programming techniques, such as decomposition principles, sensitivity analysis, and Karmarkar's interior method and apply these strategies to solve transportation and quadratic programming challenges.
CO4	Construct optimization models employing nonlinear programming methods like dynamic programming, Pontryagin's Maximum Principle, and heuristic algorithms such as Particle Swarm Optimization (PSO) and Ant Colony Optimization.

Course Contents:

Unit-1: Introduction to Optimization Introduction, Engineering Applications of Optimization, Statement of an Optimization Problem: Design, Design Constraints, Constraint Surface, Objective Function, Objective Function Surfaces, Classification of Optimization Problems: Classification Based on: the Existence of Constraints, the Nature of the Design Variables, the Physical Structure of the Problem, the Nature of the Equations Involved, the Permissible Values of the Design Variables, the Deterministic Nature of the Variables, the Separability of the Functions, the Number of Objective Functions, Optimization Techniques	[6]
Unit-2: Classical Optimization Techniques Introduction, Single-Variable Optimization, Multivariable Optimization with No Constraints: Semidefinite Case, Saddle Point, Multivariable Optimization with Equality Constraints: Solution by Direct Substitution, the Method of Constrained Variation, the Method of Lagrange Multipliers, Multivariable Optimization with Inequality Constraints: Kuhn–Tucker Conditions, Constraint Qualification	[6]
Unit-3:Linear Programming-I Introduction, Standard Form of a Linear Programming Problem, Geometry of Linear Programming Problems, Definitions and Theorems, Solution of a System of Linear	[7]

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Simultaneous Equations, Motivation of the Simplex Method, Simplex Algorithm: Identifying an Optimal Point, Improving a Nonoptimal Basic Feasible Solution, Two Phases of the Simplex Method	
Unit-4:Linear Programming-II Introduction, Duality in Linear Programming: Symmetric Primal–Dual Relations, General Primal–Dual Relations, Primal–Dual Relations When the Primal Is in Standard Form, Duality Theorems, Dual Simplex Method, Decomposition Principle; Transportation Problem, Karmarkar's Interior Method: Statement of the Problem, Conversion of an LP Problem into the Required Form, Algorithm; Quadratic Programming	[7]
Unit-5:Dynamic Programming Introduction, Multistage Decision Processes: Definition and Examples, Representation of a Multistage Decision Process, Conversion of a Non serial System to a Serial System, Types of Multistage Decision Problems; Concept of Suboptimization and Principle of Optimality, Computational Procedure in Dynamic Programming, Example Illustrating the Calculus Method of Solution.	[6]
Unit-6: Mathematical Optimization Techniques Introduction, Quadratic Forms, Unconstrained Optimization, Constrained Optimization, Pontryagin's Maximum Principle, Functional Analytic Optimization Technique: The Minimum Norm Theorem, Simulated Annealing Algorithm (SAA), Particle Swarm Optimization (PSO) Algorithm: Basic Fundamentals of PSO Algorithm, General PSO Algorithm, Ant Colony Optimization.	[7]

Textbooks/Reference Books:

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice, 4thEdition, John Wiley and Sons, Inc.2009.
2. Soliman Abdel-Hady Soliman, Abdel-Aal Hassan Mantawy, Modern Optimization Techniques with Applications in Electric Power Systems, Springer, 2012.
3. H.A. Taha, Operations Research: An Introduction, 5thEdition, Macmillan, New York, 1992.
4. K. Deb, Optimization for Engineering Design Algorithms and Examples, Prentice-Hall of India Pvt. Ltd., New Delhi, 1995
5. G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 1990.

Power Electronics Laboratory

23EE3505	PCC	Power Electronics Laboratory	0-0-2	1 Credit

Teaching Scheme	Evaluation Scheme
Practical: 2hr/week	CA1:15 Marks CA2: 15 Marks End Semester Exam: 20 Marks

Pre-Requisites: Basic Electrical Engineering

Course Outcomes: At the end of the course, students will be able to:

CO1	Analyze the static characteristics of key semiconductor devices such as SCRs, MOSFETs, IGBTs, and TRIACs, emphasizing their operational principles and applications in power electronics.
CO2	Design control circuits, including SCR turn-on circuits, digital triggering circuits, and AC voltage controllers using TRIAC-DIAC combinations, tailored to various types of loads.
CO3	Apply techniques such as semi-converters, choppers, and PWM inverters to control the speed of DC motors, stepper motors, and universal motors

Course Contents:

List of Experiments: Minimum 8 experiments should be performed from the following list.

1. Static Characteristics of SCR.
2. Static Characteristics of MOSFET and IGBT.
3. Characteristic of TRIAC.
4. SCR turn on circuit using synchronized UJT relaxation oscillator.
5. SCR digital triggering circuit for a single phase controlled rectifier and ac voltage regulator.
6. Single phase controlled full wave rectifier with R load, R –L load, R-L-E load with and without freewheeling diode
7. AC voltage controller using TRIAC and DIAC combination connected to R and RL loads.
8. Speed control of DC motor using single semi converter.
9. Speed control of stepper motor.
10. Speed control of universal motor using ac voltage regulator.
11. Speed control of a separately excited D.C. Motor using an IGBT or MOSFET chopper.
12. Single phase MOSFET/IGBT based PWM inverter.
13. To conduct survey field visit to study applications of rectifier, inverter, chopper and ac voltage controller

Textbooks/Reference Books:

1. Mohammad H Rashid, Power Electronics: Circuits Devices and Applications, Pearson 4thEdition, 2014.
2. P.S. Bimbhra, Power Electronics, Khanna Publishers, 5thEdition, 2012
3. Ned Mohan et al, Power Electronics: Converters, Applications and Design, Wiley 3rdEdition, 2014
4. Daniel W Hart, Power Electronics, McGraw Hill 1stEdition, 2011

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Industrial Automation Laboratory

23EE3506	PCC	Industrial Automation Laboratory	0-0-2	1 Credit

Teaching Scheme	Evaluation Scheme
Practical: 2hr/week	CA1: 15 Marks CA2: 15 Marks End Semester Exam: 20 Marks

Pre-Requisites: ---

Course Outcomes: At the end of the course, students will be able to:

CO1	Analyze the architecture and functionalities of Distributed Control Systems (DCS), Programmable Logic Controllers (PLC), and interface modules (AI, AO, DI, DO) to understand their roles in industrial automation systems.
CO2	Develop ladder logic programs using logic gates, timers, counters
CO3	Develop real-time PLC-based control applications such as traffic light control, servo motor operation, automatic bottle filling, and water level control systems for efficient automation.

Course Contents:

List of Experiments: Minimum 8 experiments should be performed from the following list.

1. Study hardware and software platforms for DCS
2. Study of PLC
3. Study of PLC field device interface modules (AI,AO,DI,DO modules)
4. Programming Logic Gates in PLC
5. Study, understand and perform experiments on timers and counters using PLC
6. Traffic Light Control using PLC
7. Automatic water level control system using PLC
8. Direct On line(DOL) Starting of Induction Motor with/without latching
9. Servo motor control using PLC
10. Automatic Forward and Reverse Control
11. Automatic bottle filling machine using PLC

Textbooks/ Reference Books:

1. George Nikolakopoulos and Stamatios Manesis, Introduction to Industrial Automation, CRC Press, 1st Edition, 2020.
2. A.K. Gupta and S.K. Arora, Industrial Automation and Robotics: An Introduction, Mercury Learning and Information, 1stEdition, 2016.
3. Kaushik Kumar and B. Sridhar Babu, Industrial Automation and Robotics: Techniques and Applications, CRC Press, 1st Edition, 2023.

4. Richard L. Shell, Handbook of Industrial Automation, CRC Press, 1st Edition, 2000.
5. R.G. Jamkar, Industrial Automation Using PLC, SCADA and DCS, Global Education Limited, 2nd Edition, 2018.

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Electrical Machine Design Laboratory

23EE3507	PCC	Electrical Machine Design Laboratory	0-0-2	1 Credit

Teaching Scheme	Evaluation Scheme
Practical: 2hr/week	CA1: 25 Marks CA2: 25 Marks

Pre-Requisites: DC Machines and Transformers, AC Machines

Course Outcomes: At the end of the course, students will be able to:

CO1	Design electrical components such as chokes, starters, transformers, and three-phase induction motors, along with detailed design reports and general assembly sheets.
CO2	Develop detailed drawing sheets for simplex lap winding, wave winding, and AC lap winding, utilizing computer-aided design software like AutoCAD.
CO3	Analyze the use of symbols in electrical engineering and their application in designing and assembling electrical systems and components.

Course Contents:

List of Experiments: Minimum 8 experiments should be performed from the following list.

1. Symbols used in Electrical Engineering
2. Design and assembly of Choke with design report.
3. Design and assembly of Starter with design report.
4. Design and layout of simplex lap winding
5. Design and layout of wave winding
6. Design and layout of ac lap winding
7. Design and assembly of transformer with design report.
8. Design and assembly of three phase induction Motor with design report
9. Complete any two drawings sheets with the help of CAD Software

Textbooks:

1. A. K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai and Sons, Delhi.
2. V.N. Mittle and A. Mittle, Design of Electrical Machines, Standard Publications and Distributors, Delhi.

Reference Books:

1. R. K. Agarwal, Principles of Electrical Machine Design, S. K. Kataria and Sons, Delhi.
2. S.K. Sen, Principles of Electrical Machine Design with Computer Programmes, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Mini Project-IV

23EE3508	CEP	Mini Project IV	0-0-2	Audit

Teaching Scheme	Evaluation Scheme
Practical: 2 hrs/week	CA1: 25 Marks CA2: 25 Marks

Pre-Requisites:

About Hackathon

The project is a part of addressing societal and industrial needs. Hackathon is one of the platforms where students will solve real world challenges. This Course focuses on the selection of methods/engineering tools/analytical techniques for problem solving.

Through this course, students will gain the understanding of engineering basics and ideas, gain practical experience, have the opportunity to display their skills and learn about teamwork, financial management, communication skills and responsibility

Course Outcomes: At the end of the course, students will be able to:

CO1	Select the appropriate method for solving the problem
CO2	Make use of various engineering techniques and tools to give a solution
CO3	Justify the methods /tools used to develop the solution
CO4	Design / simulate the model/ project work
CO5	Describe the solution with help of a project report and presentation
CO6	Conclude the outcomes of project.

Course Contents:

Week 1:Survey Design-1 • Ensure case study group students have made necessary communication and done a preparatory visit. • Watch the lecture on survey design and study the notes. • Prepare a questionnaire and try it out with your group members as mock.	[2]
Week 2: Survey Design-2 • Review survey questionnaire prepared by case study groups. • Decide sampling strategy. • Prepare a detailed schedule for fieldwork	[2]
Week 3: Fieldwork • Data Collection: Collect quantitative data (e.g., statistics, usage metrics) and qualitative data (e.g., user stories, testimonials). • Use data collection tools like questionnaires, observation checklists, and digital analytics. • Ensure data accuracy and reliability through proper sampling and recording methods. • 25% Presentation has to be conducted by mentor/guide based on above activity.	[2]

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Week 4: Trails and Experimentation-1 • Initial Setup and Configuration • Concept Validation • Feasibility Testing	[2]
Week 5: Trails and Experimentation-2 • Prototyping • Functionality Testing	[2]
Week 6: Trails and Experimentation-3 • Bug Identification and Fixing • Integration Testing • Security Testing • 75% Presentation has to be conducted by mentor/guide based on above activity.	[2]
Week 7: Results • Coordinator has to check and verify below points in term of result: • Functional Performance • Accuracy and Precision • Efficiency • Safety	[2]
Week 8: Validation • Coordinator has to check and verify below points in term of validation: • Testing and Verification • Compliance with Standards • 75% Presentation has to be conducted by mentor/guide based on above activity.	[2]
Week 9: Integration Testing • Validate that the hardware integrates seamlessly with other systems or components as intended • Perform compatibility tests with software, other hardware, and network systems.	[2]
Week 10:Documentation and Reporting • Maintain comprehensive documentation of design, development, testing, and validation processes • Provide detailed reports on test results, issues found, and corrective actions taken.	[2]
Week 11: Final Presentation • 100% Presentation has to be conducted by mentor/guide based on above activity. • Prototype/Final Software solution is mandatory at the time of final presentation along with report	[2]
Week 12: Exhibition • Mini project exhibition will be schedule with interdepartmental evaluation.	[2]

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Multidisciplinary Minor -III: Lighting System Design

23EEMDA3	MDM	Lighting System Design	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA1: 10 Marks CA2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Electrical System Planning and Design, and Electrical Estimation and Costing

Course Outcomes: At the end of the course, students will be able to:

CO1	Analyze the physics of light and colour, human vision response, photometric quantities, and mechanisms of light generation like incandescence and luminescence.
CO2	Compare various lighting technologies, including incandescent, fluorescent, LED, HID, and laser-based sources, in terms of efficiency, spectral characteristics, and lifetime.
CO3	Select appropriate light sources and luminaires for different applications.
CO4	Apply advanced lighting control systems, including dimmers, timers, motion sensors, and IoT-based protocols like DALI, KNX, and DMX, to enhance energy efficiency and integrate renewable energy sources such as solar lighting.
CO5	Evaluate energy efficiency metrics, eco-friendly lighting solutions, and sustainable practices by applying standards like ASHRAE, LEED, and IEC.
CO6	Apply lighting simulation tools and international standards to design real-world lighting systems.

Course Contents:

Unit 1: Fundamentals of Lighting Nature of Light: Physics of Light and Colour, Human Vision and Eye Response, Illuminance, Luminance, and Luminous Efficacy, Photometric Quantities: Lumens, Lux, Candela, Basics of Light Generation (Incandescence, Luminescence).	[6]
Unit 2: Light Sources and Luminaires Incandescent, Fluorescent, LED, HID, and Laser-Based Lighting, Luminous Efficiency and Spectral Characteristics of Light Sources, Luminaire Components and Optical Design, Comparison of Lighting Technologies in Terms of Efficiency and Lifetime, Case Studies on LED vs. Traditional Lighting.	[6]
Unit 3: Lighting System Design Principles Indoor vs. Outdoor Lighting Considerations, Residential, Commercial, and Industrial Lighting Design, Lumen Method and Point-by-Point Method for Illumination Calculation, Lighting for Specific Applications (Offices, Stadiums, Roads, Theaters), Role of Reflectors, Diffusers, and Refractors in Luminaires.	[6]
Unit 4: Lighting Control System Role of Lighting Controls in Energy Efficiency, Dimmers, Timers, Motion Sensors, and Daylight Sensors, Smart Lighting and IoT-Based Controls, Basics of DALI, KNX, and DMX Lighting Protocols, Integration of Renewable Energy (Solar Lighting).	[6]
Unit 5: Energy Efficiency and Sustainability Energy Codes and Standards (ASHRAE, IEC, BIS, LEED), Energy Audits and Lighting	[6]

Efficiency Metrics, LED Retrofits and Cost-Benefit Analysis, Light Pollution and Eco-Friendly Lighting, Case Study: Sustainable Lighting Projects.	
Unit 6: Lighting Simulation and Standards Introduction to Lighting Simulation Software (DIALux, Relux, AGi32) , Interpretation of Photometric Data Files (IES, LDT) , International Lighting Standards and Guidelines (IESNA, CIE, EN 12464-1) , Safety and Regulatory Compliance in Lighting Design , Final Project: Lighting System Design for a Real-World Application.	[6]

Text Books/Reference Books:

1. Mark Karlen, Christina Spangler, James R. Benya, Lighting Design Basics, Wiley, 4th Edition, 2024
2. Gary Gordon, Interior Lighting for Designers, Wiley, 5th Edition, 2015.
3. David L. DiLaura, Kevin W. Houser, Richard Mistrick, Gary Steffy, The IES Lighting Handbook, Illuminating Engineering Society, 10th Edition, 2011.
4. Mark Karlen, Christina Spangler, Lighting Design Basics, Wiley, 3rd Edition, 2017.

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Multidisciplinary Minor -III: Industrial Automation

23EEMDB3	MDM	Industrial Automation	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA1: 10 Marks CA2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Introduction to PLC, SCADA and HMI

Course Outcomes: At the end of the course, students will be able to:

CO1	Apply knowledge of industrial automation types, pyramid structure, and process control to assess manufacturing systems effectively.
CO2	Analyze the working principles and industrial applications of sensors and actuators, including pneumatic, hydraulic, and electric systems.
CO3	Develop programmable logic controller (PLC) systems using ladder logic, timers, counters, and communication interfaces for industrial automation.
CO4	Summarize industrial communication protocols and networks, such as Fieldbus, Ethernet, and wireless systems, to ensure cybersecurity and efficient communication.
CO5	Develop SCADA and HMI systems for effective data logging, alarm management, and remote monitoring of industrial operations.
CO6	Apply Industry 4.0 concepts, including IoT, AI, cloud computing, digital twin technology, and predictive maintenance, to enhance automation and implement smart manufacturing solutions.

Course Contents:

Unit 1: Introduction to Industrial Automation Definition and Need for Industrial Automation, Types of Automation: Fixed, programmable, and Flexible Automation , Advantages and Challenges in Industrial Automation, Industrial Automation Pyramid: Sensors, Controllers, and Actuators , Overview of Process Control and Manufacturing Automation	[6]
Unit 2: Sensors and Actuators Types of Industrial Sensors (Proximity, Temperature, Pressure, Optical, Ultrasonic),Working Principles and Applications of Sensors, Actuators: Pneumatic, Hydraulic, and Electric Actuators , Signal Conditioning and Data Acquisition , Industrial Applications of Sensor-Actuator Systems	[6]
Unit 3: Programmable Logic Controllers Introduction to PLCs: Architecture, Operation, and Types , Ladder Logic Programming and PLC Programming Languages (IEC 61131-3), Timers, Counters, Relays, and Data Handling in PLCs, PLC Communication Interfaces (RS232, RS485, Ethernet), PLC Applications in Industrial Automation	[6]
Unit 4: Industrial Communication and Networks Basics of Industrial Communication, Fieldbus Protocols: Profibus, Modbus, CAN, DeviceNet, Industrial Ethernet: PROFINET, EtherCAT, Ethernet/IP, Wireless	[6]

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Communication in Industrial Automation , Cybersecurity in Industrial Networks	
Unit 5: SCADA and HMI Systems Introduction to Supervisory Control and Data Acquisition (SCADA) , SCADA Components: RTUs, MTUs, HMIs , Human-Machine Interface (HMI) Design Principles Data Logging, Alarm Management, and Remote Monitoring, Case Study: SCADA Applications in Power Plants and Manufacturing	[6]
Unit 6: Industry 4.0 and Smart Manufacturing Introduction to Industry 4.0: IoT, AI, and Cloud Computing in Automation , Digital Twin Technology, Industrial Robotics and Collaborative Robots (Cobots), Predictive Maintenance using Machine Learning, Industrial Case Study: Smart Factory Implementation.	[6]

Text/ Reference Books:

1. George Nikolakopoulos and Stamatios Manesis, Introduction to Industrial Automation, CRC Press, 1st Edition, 2020.
2. A.K. Gupta and S.K. Arora, Industrial Automation and Robotics: An Introduction, Mercury Learning and Information, 1stEdition, 2016.
3. Kaushik Kumar and B. Sridhar Babu, Industrial Automation and Robotics: Techniques and Applications, CRC Press, 1st Edition, 2023.
4. Richard L. Shell, Handbook of Industrial Automation, CRC Press, 1stEdition, 2000.
5. R.G. Jamkar, Industrial Automation Using PLC, SCADA and DCS, Global Education Limited, 2nd Edition, 2018.

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Multidisciplinary Minor -III: Smart Grid

23EEMDC3	MDM	Smart Grid	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	CA1: 10 Marks CA2: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Energy Storage System, Grid Integration of RES

Course Outcomes: At the end of the course, students will be able to:

CO1	Analyze the evolution, key features, and global implementations of smart grids to understand their role in reliability, efficiency, and sustainability.
CO2	Apply advanced metering infrastructure and demand response programs, including TOU and RTP mechanisms, to optimize consumer participation and energy management.
CO3	Take-part in renewable energy sources like solar and wind, along with energy storage technologies, to address challenges in smart grid implementation.
CO4	Apply communication architectures and IoT-based smart sensors using wireless technologies to enhance smart grid monitoring and operations.
CO5	Evaluate security threats, encryption mechanisms, and data analytics techniques for load forecasting, fault detection, and grid optimization.
CO6	Interpret smart grid standards, policies, and future trends to propose innovative solutions like V2G and transactive energy for smart grid modernization.

Course Contents:

Unit 1: Introduction to Smart Grid Definition and Evolution of Smart Grid, Traditional Grid vs. Smart Grid , Need for Smart Grids: Reliability, Efficiency, and Sustainability, Key Features and Components of Smart Grid , Case Studies of Smart Grid Implementation Worldwide	[4]
Unit 2: Smart Metering and Demand Response Advanced Metering Infrastructure (AMI) and Smart Meters , Demand-Side Management (DSM) and Demand Response Programs , Time-of-Use (TOU) and Real-Time Pricing (RTP) Mechanisms, Net Metering and Consumer Participation , Home Energy Management Systems (HEMS)	[5]
Unit 3: Renewable Energy Integration and Energy Storage Solar, Wind, and Biomass Integration into Smart Grid , Distributed Energy Resources (DERs) and Microgrids , Energy Storage Technologies: Battery Storage, Pumped Hydro, Supercapacitors , Grid-Tied vs. Off-Grid Systems , Challenges and Solutions in Renewable Energy Grid Integration	[5]
Unit 4: Smart Grid Communication and IoT Applications Communication Architectures for Smart Grid , IoT and Smart Sensors in Smart Grids , Wireless Technologies: Zigbee, LoRa, Wi-Fi, 5G, and LPWAN , SCADA for Smart Grid Monitoring , Cloud Computing and Edge Computing in Smart Grid	[3]
Unit 5: Cybersecurity and Data Analytics in Smart Grid Security Threats and Vulnerabilities in Smart Grids , Encryption and Authentication	[3]

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Mechanisms , Blockchain Applications in Smart Grid Security , AI and Machine Learning for Load Forecasting and Fault Detection , Big Data Analytics for Grid Optimization	
Unit 6: Smart Grid Policies, Standards, and Future Trends IEEE, NIST, and IEC Smart Grid Standards , Government Policies and Regulations on Smart Grids , Case Studies on Smart Cities and Grid Modernization , Future Trends: AI-Driven Grids, V2G (Vehicle-to-Grid), Transactive Energy , Smart Grid Business Models and Economic Aspects	[4]

Textbooks / Reference Books:

1. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Smart Grid: Technology and Applications, Wiley, 1st Edition, 2012.
2. Dr. Subir Sen, Mr. Rajesh Kumar, Dr. D.P. Kothari, Smart Grid: Fundamentals and Applications, New Age International (P) Ltd., Publishers, 1st Edition, 2019.
3. Sudip Misra, Samaresh Bera, Smart Grid Technology: A Cloud Computing and Data Management Approach, Cambridge University Press, 1st Edition, 2018.
4. Bharat Modi, Anu Prakash, Yogesh Kumar, Fundamentals of Smart Grid Technology, S.K. Kataria and Sons, 2015.
5. James A. Momoh, Smart Grid: Fundamentals of Design and Analysis, Wiley-IEEE Press, 1st Edition, 2012.
6. Ali Keyhani, Mohammad N. Marwali, Min Dai, Integration of Green and Renewable Energy in Electric Power Systems, 1st Edition, John Wiley and Sons, 2009.

Aptitude Skills-III
(Verbal Ability)

23HSSM05	VEC	Aptitude Skills- III	1-0-0	Audit

Teaching Scheme	Evaluation Scheme
Lecture: 1hr/week	CA1: 25 Marks CA2: 25 Marks

Pre-Requisites: Aptitude Skills-I and II

Course Outcomes: At the end of the course, students will be able to:

CO1	Solve the questions on ordering of words and Parts of Speech
CO2	Organize contents of Business Communications such as CV, emails and letters.
CO3	Solve the questions based on jumbled paragraphs and reading comprehension.
CO4	Solve the questions on spotting error and sentence correction.
CO5	Summarize proceedings of any event or conference.
CO6	Discuss about current and critical issues during group discussion.

Course Contents:

Unit 1	Parts of Speech, Punctuation Word Family (Using the same word as different Parts of Speech)	**[2]**
Unit 2	Analogy, Letter Writing(Formal), E-Mail Writing, CV Writing	**[2]**
Unit 3	Reading Comprehension, Paragraph Jumbles	**[2]**
Unit 4	Spotting Errors(in different part sof sentence),Subject-Verb Agreement Sentence Correction, Sentence Completion	**[2]**
Unit 5	OneWordSubstitution,NarratingEvents/Reports,Summary/PrecisWriting	**[2]**
Unit 6	Dialogue writing Group Discussion, Interview Skills (Using formal notations and gestures etc.)	**[2]**

Textbooks:

1. Raymond Murphy, Essential English Grammar with Answers, Murphy
2. Objective General English by R.S.Aggarwal, S Chand Publishing; Revised edition.

Reference Books:

1. Rao and D, V,Prasada, Wren and amp; Martin High School English Grammar and Composition Book, S Chand Publishing, 2017
2. Murphy, Intermediate English Grammar with Answers, Cambridge University Press, Second edition

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Electrical Engineering
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Language Skills-III

23HSSM05	HMS06	Language Skills- III	0-0-2	Audit

Teaching Scheme	Evaluation Scheme
Practical: 2hrs/week	CA1: 25 Marks CA2: 25 Marks

Pre-Requisites: Language Skills-I and II

Course Outcomes: At the end of the course, students will be able to:

CO1	Develop a program to read input and return output.
CO2	Develop a program using data types, Strings and variables
CO3	Develop a program using Unary, Binary and Ternary operator
CO4	Develop a program using Conditional and Logical statements.

Course Contents:

1. **Write a Python program to print "Hello, World!"** ○ Objective: Understand basic syntax, indentation, and output.	[2]
2. **Write a program to demonstrate the use of different types of comments in Python.** ○ Objective: Single-line and multi-line comments.	[2]
3. **Write a Python program that declares different types of variables and displays their data types using the type() function.** ○ Objective: Variables, data types, and type identification.	[2]
4. **Write a program to demonstrate type casting and type conversion between int, float, and string.** ○ Objective: Type conversion, casting functions.	[2]
5. **Write a Python script to perform string operations such as slicing, concatenation, upper(), lower(), and len().** ○ Objective: String manipulation and built-in functions.	[2]
6. **Write a program to demonstrate the use of all arithmetic, logical, and bitwise operators.** ○ Objective: Operator functionality.	[2]
7. **Write a Python program to use membership and identity operators with examples.** ○ Objective: in, not in, is, is not.	[2]
8. **Write a Python program using a ternary operator to find the larger of two numbers.** ○ Objective: Conditional (inline) expressions.	[2]
9. **Write a program that takes user input for age and prints whether the person is a child, teenager, adult, or senior citizen using if-elif-else.** ○ Objective: Conditional statements and user input.	[2]

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10. **Write a program to find the sum of the first 10 natural numbers using a while loop.** ◦ Objective: Looping with while.	[2]
11. **Write a Python script to display the multiplication table of a number using a for loop.** ◦ Objective: Looping with for and range().	[2]
12. **Write a program that uses break, continue, and pass statements in appropriate looping scenarios.** ◦ Objective: Loop control statements.	[2]

Textbooks:

1. Python Projects, Laura Cassell, Alan Gauld, Wrox publication
2. Murach's Python Programming, Michael Urban, Joel Murach, Murach's Publication.

Reference Books:

1. Fundamentals of Python (First Program), K.A. Kambert, Cengage MINDTAP Publication 2nd Edition.

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Industrial Training

23EE3509	CEP	Industrial Training	0-0-0	Audit

Teaching Scheme	Evaluation Scheme
Lecture: Nil	End Semester Exam: 50 Marks

Course Outcomes: Students will be able to

CO1	Examine actual working environment
CO2	Demonstrate the use, interpretation and application of an appropriate engineering standard in a specific situation.
CO3	Identify sources of hazards, and assess/identify appropriate health & safety measures.
CO4	Summarize technical documents and give presentations related to the work completed

Instruction:

Students are expected to undergo industrial training for at least four weeks after IV semester. Training session shall be guided and certified by qualified engineer / industry expert. Students should prepare detailed report on activities carried out during training. Evaluation shall be based on report and power point presentation.

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