Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

Yadrav (Ichalkaranji), Dist: Kolhapur, Maharashtra-416121

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

Class: S.Y. B. Tech. **Semester:** III

Course Code	Course Type	Course	Teaching Scheme				Examination Scheme					Credits
			L	T	P	Total Hrs.	CAI	CAII	MSE	ESE	Total	
23EE2301	PCC	Network Analysis	3	-	-	3	10	10	30	50	100	3
23EE2302	PCC	Measurement & Instrumentation	3	-	-	3	10	10	30	50	100	3
23EE2303	PCC	DC Machines & Transformers	3	-	-	3	10	10	30	50	100	3
23EE2304	EEM	Project Management	2	-	-	2	25	25	-	-	50	2
23EE2305	MC	Environmental Sciences	2	-	-	2	25	25	-	-	50	Audit
23EE2306	PCC	Network Analysis Laboratory	-	-	2	2	25	25	-	-	50	1
23EE2307	PCC	Measurement & Instrumentation Laboratory	-	-	2	2	15	15	-	20	50	1
23EE2308	PCC	DC Machines & Transformers Laboratory	-	-	2	2	15	15	-	20	50	1
23EE2309	CEP	Mini Project-II	-	-	2	2	25	25	-	-	50	1
23OEEE21	OEC	Open Elective – I	2	-	-	2	10	10	30	50	100	2
23EEMDXX	MDM	Multidisciplinary Minor- I	2	-	-	2	10	10	30	50	100	2
23HSSM01	VEC	Aptitude Skills-I	1	-	-	1	25	25	-	-	50	1
23HSSM02	VEC	Language Skills-I	-	-	2	2	25	25	-	-	50	1
Total			**18**	**-**	**10**	**28**	**230**	**230**	**150**	**290**	**900**	**21**

Multi-Disciplinary Minor Course-I

Electrical System Design **(Basket - A)**	Automation & IOT **(Basket - B)**	Renewable Energy Sources & Grid Integration **(Basket - C)**
Electrical System Planning & Design (23EEMDA1)	Introduction to PLC (23EEMDB1)	Energy Storage Systems (23EEMDC1)

*Open Elective course will be offered to students of other programs and will not be offered to students of the same program.

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Network Analysis

23EE2301	PCC	Network Analysis	3-0-0	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs/week Tutorial: -- Practical: --	Continuous Assessment-I: 10 Marks Continuous Assessment-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basic Electrical Engineering, Fundamentals of Electrical Circuits.

Course Outcomes:

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

CO1	**Analyze** the performance of the network by determining the equivalent circuits using Thevenin's and Norton's theorems, maximizing power transfer using Maximum Power Transfer theorem, Reciprocity, Tellegen's and Millman's theorem for the electrical networks with DC excitation.
CO2	**Apply** the properties of Laplace Transform in circuit analysis to solve complex circuit problems.
CO3	**Apply** the Inverse Laplace Transform to solve numerical problems involving simple poles, repeated poles, and complex poles and analyse the properties of the Inverse Laplace Transform.
CO4	**Solve** initial and final conditions in RL, RC, and RLC circuits for both AC and DC excitations and analyse circuit elements under switching conditions.
CO5	**Apply** graph theory to analyse network topology and develop associated matrices, including incidence matrix, fundamental loop and cutset matrices.
CO6	**Solve** Z and Y parameters, ABCD and h parameters, of two-port networks.

Course Contents:

Unit 1: Network Theorems Thevenin's and Norton's theorems, Duality, Maximum Power transfer theorem, Millman's theorems, Reciprocity Theorem, and Tellegen's theorem.	[6]
Unit 2: Laplace Transform in Circuit Analysis: Laplace Transform, Properties of Laplace Transform, Circuit Analysis using Laplace Transform, Advantages, Disadvantages and Applications of Laplace Transform in Circuit Analysis, Simple Numerical Problems	[6]
Unit 3: Inverse Laplace Transforms The Inverse Laplace Transform: Simple Poles, Repeated Poles, Complex Poles; Inverse Laplace Transform Theorem: Linearity Theorem, Shifting Theorem, Convolution Theorem, Properties of Inverse Laplace Transform, Advantages, Disadvantages and Applications of	[6]

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Inverse Laplace Transform, Simple Numerical Problems	
Unit 4: Transient Analysis Behavior of circuit elements under switching condition and their Representation, Evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations with Laplace transforms.	[6]
Unit 5: Network Topology Basic Terminology: Graph, Types of Graphs, Planar and Non-Planar Graph, Tree, Co-tree, Matrices Associated with Network Graphs: Incidence Matrix, Fundamental Loop Matrix, Fundamental Cutset Matrix with examples,	[6]
Unit-6: Two Port Network Parameters Concept of complex frequency, Transform impedance & transform admittance; Definition and classification of Two port network parameters: Z, Y, h and Transmission parameters, relationship between parameters sets, Interconnections of Two-Port Network, condition for symmetry and reciprocity, numerical problems.	[8]

Text Books:

1. M.E. Van Valkenberg, Network Analysis, Prentice Hall of India, 3rd Edition, 2000.
2. Charles K Alexander and Mathew N O Sadiku, Fundamentals of Electric Circuits, TMH, 3rd Edition, 2009.

Reference Books:

1. Hayt, Kemmerly and Durbin, Engineering Circuit Analysis, TMH, 7th Edition, 2010.
2. J. David Irwin and R. Mark Nelms, Basic Engineering Circuit Analysis, John Wiley, 8th Edition, 2006.
3. Roy Choudhury, Networks and Systems, 2nd Edition, New Age International Publications, 2006.
4. Joseph A. Edminister, Mahmood Maqvi, "Theory and Problems of Electric Circuits", Schaum's Outline Series.
5. Robert L Boylestad, "Introductory Circuit Analysis", Pearson Publications.

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Measurement & Instrumentation

23EE2302	PCC	Measurement & Instrumentation	3-0-0	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs/week Tutorial:- - Practical: -	Continuous Assessment -I:10 Marks Continuous Assessment -II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basic Electrical Engineering

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

CO1	Explain the principles underlying measurement instruments, including characteristics, errors, classification, and standards used in electrical measurements.
CO2	Analyze the construction, working principles, advantages, and disadvantages of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI), and Dynamometer type instruments.
CO3	Apply shunt and multiplier techniques to extend the range of Moving Iron (MI) instruments through practical problem-solving exercises.
CO4	Evaluate the construction, working principles, torque equations, and calibration methods of single-phase conventional energy meters used for the measurement of active and reactive power.
CO5	Design and implement measurement circuits using Wheatstone Bridge, Kelvin's Double Bridge, and other bridge circuits for the measurement of resistance, inductance, and capacitance.
CO6	Assess the selection, characteristics, and applications of various transducers, including resistive, capacitive, inductive, piezoelectric, Hall effect, optical, and digital transducers, and propose suitable transducers for specific measurement requirements.

Course Contents:

Unit 1: Characteristics of Measuring Instruments Characteristics of measuring instruments, Errors & its types, Classification of instruments, Standards, torque in measuring instruments, Construction & working principle advantages and disadvantages of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) and Dynamometer type instruments, shunt and multipliers for range extension of MI Instruments (Numerical)	[6]
Unit 2: Measurement of Power and Energy Measurement of active & reactive power in electrical circuit, Construction, working principle, torque equation of single phase conventional (induction type) energy meter, Calibration of energy meter, block diagram and operation of digital Energy Meter.	[6]

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Unit 3: Measurement of Resistance, Inductance and Capacitance Measurement of low, medium and high resistance, Wheatstone Bridge, Kelvin's Double Bridge, Ammeter-Voltmeter method, Megger, Earth tester for earth resistance measurement. Inductance measurement: Maxwell's inductance Bridge, Maxwell's inductance capacitance bridge, Hay's Bridge, Anderson's Bridge, Schering Bridge and Wien's Bridge.	[8]
Unit 4: Transducers Transducers: Classification of transducers, general characteristics, Selection of transducers, Resistive, Capacitive & Inductive Transducers, Piezoelectric, Hall effect, optical and digital transducers, Elements of data acquisition system , Smart Sensors-Thermal Imagers.	[6]
Unit 5: Digital Meters Digital instruments - pros and cons, working of digital voltmeters, Digital frequency meter, time interval measurement, digital LCR meter, digital multi-meters, Digital Tachometer, microprocessor-based instruments, Use of digital meters in Automization.	[6]
Unit 6: Storage & Display Devices DSO, CRO, Power Analyzer, Wave Analyzer & Harmonic Distortion, Spectrum Analyzer, Instrument Transformers: Construction, connection of CT & PT in the circuit, advantages of CT / PT, LED & LCD display.	[6]
Text Books: 1. R K Rajput, Electrical & Electronic Measurement s and Instrumentation, S Chand Publishing, 2015. 2. Sawhney, A. K., A Course in Electrical and Electronic Measurement and Instrumentation, Dhanpat Rai & Sons, New Delhi.	
Reference Books: 1. H.S Kalsi , Electronic Instrumentation, TMH, 2010 2. U. A. Bakshi, A.V. Bakshi, K. A. Bakshi, Electrical Measurements, Technical Publications	

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DC Machines & Transformers

23EE2303	PCC	DC Machines & Transformers	3-0-0	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs/week Tutorial: -- Practical: --	Continuous Assessment -I: 10 Marks Continuous Assessment -II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basic Electrical Engineering

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

CO1	Explain the construction, types, and basic components of DC machines, special machines, and transformers.
CO2	Explain the working principles and characteristics of DC motors and transformers.
CO3	Determine emf in DC generators, torque and efficiency in DC motors, and voltage regulation in transformers.
CO4	Evaluate the performance, efficiency, and applications of DC machines, and transformers

Course Contents:

Unit 1: DC Generators Construction, Working, types, emf equation, armature reaction, Characteristics, Testing of DC Generators- O.C.C Test, Direct Load Test, applications, Numerical.	[6]
Unit 2: DC Motors Principles of working, Significance of back emf, Torque Equation, Types, Characteristics of DC Motors, Starting of DC Motors, Speed Control, Losses and Efficiency (Numerical), Braking of DC Motors, Testing of DC Motors- Brake Load, Swinburne's Test, Hopkinson's Test, Applications	[7]
Unit 3:Special Machines Construction, working principle, types & applications of stepper motors, Brushless DC motors, Permanent Magnet DC Motors, Servo motor.	[5]
Unit 4:Single Phase Transformer Transformer construction, Ideal and practical transformer, equivalent circuits, no load and on load operation, phasor diagrams, efficiency and voltage regulation (Numerical), parallel operation, excitation phenomenon in transformers, Testing of single-phase transformers, Applications.	[6]
Unit 5:Three Phase Transformers Constructional features of three phase transformers, cooling methodology, transformer connections, Phase conversion, Parallel operation of three phase transformers, tap changing of transformers, Testing of Three phase transformers, Applications.	[6]

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Unit 6:Special Transformers Auto transformers, Variable frequency transformer, voltage and current transformers, welding transformers, Pulse transformer, applications.	[6]

Text Books:

1. Bhattacharya S. K, Electrical Machines, Tata McGraw Hill Publications
2. Ashfaq Husain, Electrical Machines, Dhanpat Rai & sons New Delhi
3. Kothari Nagrath, Electrical Machines, Tata McGraw Hill Publications
4. M. N. Bandopadhyay, Electrical Machines, Tata McGraw Hill Publications

Reference Books:

1. Fitzerland, Electrical Machines, Tata McGraw Hill Publications
2. A.K.Sawhney, A Course in Electrical Machine Design, Dhanpat Rai & sons New Delhi
3. R. K. Agarwal, Principles of Electrical Machine Design, S. K. Kataria and sons.
4. J. B. Gupta, Electrical Machines, S.K. Kataria & Sons.

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Project Management

23EE2304	EEM	Project Management	2-0-0	2 Credits

Teaching Scheme	Examination Scheme
Lecture: 2 hrs/week Tutorial: -- Practical: --	Continuous Assessment -I: 25 Marks Continuous Assessment -II: 25 Marks End Semester Exam: --

Pre-Requisites: --

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

CO1	Define project management concepts and processes, including initiation, planning, execution, monitoring, controlling, and closure, using the PMBOK Guide.
CO2	Analyze project requirements and synthesize a comprehensive project scope statement and work breakdown structure (WBS) to ensure project deliverables align with stakeholder expectations.
CO3	Evaluate project schedules using Critical Path Method (CPM) and apply network diagramming techniques to identify critical paths and optimize project timelines.
CO4	Calculate project costs using various estimation techniques and interpret Earned Value Management (EVM) metrics to track project performance and forecast budget deviations.
CO5	Assess project risks through identification, analysis, and prioritization, and develop risk response plans to mitigate potential threats and capitalize on opportunities.
CO6	Appraise team dynamics and facilitate effective communication strategies, leadership techniques, and conflict resolution methods to foster collaboration and enhance project.

Course Contents:

Unit 1: Introduction to Project Management Overview of project management: definition, importance, and key concepts, Project life cycle: initiation, planning, execution, monitoring and controlling, closure, Project management processes and knowledge areas according to the PMBOK Guide.	[4]
Unit 2: Project Planning and Scope Management Project planning process: defining project objectives, scope, and deliverables, Work breakdown structure (WBS) development and decomposition techniques, Scope management: scope statement, scope verification, and scope control.	[4]
Unit 3: Project Scheduling Techniques for project scheduling: Gantt charts, network diagrams (PERT/CPM), Critical Path Method (CPM) and its applications in project scheduling,	[4]
Unit 4: Project Time & Cost Management Time management: estimating activity durations, scheduling constraints, and resource levelling, Cost estimation techniques: bottom-up estimation, analogous estimation, parametric estimation, Budgeting and cost control: budget development, cost monitoring, and cost performance analysis, Earned Value Management (EVM) and its use in project cost tracking and forecasting	[6]

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Unit 5: Project Risk Management Risk identification, analysis, and assessment techniques, Risk response planning: risk mitigation, avoidance, transfer, and acceptance strategies, Risk monitoring and control: tracking identified risks, implementing risk responses, and updating risk management plans.	[3]
Unit 6: Project Team Management and Communication Team formation and development: roles, responsibilities, and team dynamics, Effective communication strategies: communication planning, stakeholder engagement, and conflict resolution, Leadership and motivation: motivating team members, resolving conflicts, and fostering collaboration.	[3]

Text Books:

1. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling, and Controlling
2. Clifford F. Gray and Erik W. Larson, Project Management: The Managerial Process
3. Project Management Institute (PMI), A Guide to the Project Management Body of Knowledge (PMBOK Guide)
4. John M. Nicholas and Herman Steyn, Project Management for Engineering, Business, and Technology
5. Robert K. Wysocki, Effective Project Management: Traditional, Agile, Extreme

Reference Books:

1. David I. Cleland and Lewis R. Ireland, Project Management: Strategic Design and Implementation
2. Eric Verzuh, The Fast Forward MBA in Project Management
3. Greg Horine, Project Management: Absolute Beginner's Guide
4. Harold Kerzner, Project Management Case Studies
5. Jeff Sutherland, Scrum: The Art of Doing Twice the Work in Half the Time

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Environmental Sciences

23EE2305	MC	Environmental Sciences	2-0-0	Audit

Teaching Scheme	Examination Scheme
Lecture: 2 hrs/week	Continuous Assessment -I: 25 Marks
Tutorial: --	Continuous Assessment -II: 25 Marks
Practical: --	End Semester Exam: --

Pre-Requisites: NA

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

CO1	Explain various natural resources and associated Problems.
CO2	Summarize various ecosystems.
CO3	Explain the importance of conservation of biodiversity and its importance in balancing the earth.
CO4	Recognize various causes of environmental pollution along with various protection acts in India to limit the pollution.
CO5	Extract the information based of field study and prepare a report.

Course Contents:

Unit 1: Nature of Environmental Studies: Definition, scope and importance, Multidisciplinary nature of environmental studies. Need for public awareness.	**[2]**
Unit 2: Natural Resources and Associated Problems: a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems. c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources. d) Energy resources: Growing energy needs, renewable and non-renewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy. e) Land resources: Solar energy, Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification. f) Role of individuals in conservation of natural resources	[6]
Unit 3: Ecosystems: Concept of an eco-system. Structure and function of an ecosystem. Producers, consumers and de composers. Energy flow in the eco system. Ecological succession. Food chain etc. in concern with forest ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chain etc. in concern with Grassland ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chain etc. in concern with Desert ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chain etc. in concern with various aquatic ecosystems	[4]

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Unit 4: Biodiversity: Introduction- Definition: genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Various approaches for the conservation of biodiversity.	[4]
Unit 5: Environmental Pollution and Environmental Protection: Definition: Causes, effects and control measures of various types of pollution. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution, Concept of sustainable development: From Unsustainable to Sustainable development, Various environmental Protection Acts and their scope.	[4]
Unit 6: Field Work: The student should Visit to a local area to document environmental Assets-River/Forest/Grassland/Hill/Mountain. Or Visit to a local polluted site - Urban / Rural / Industrial /Agricultural. Or Study of common plants, insects, birds or Study of simple ecosystems - ponds, river, hill slopes, etc. **The student should expect to do this activity in a group size of 4-5 and prepare and submit a report on it.**	[4]
Text/Reference Books: 1. Agarwal, K.C., Environmental Biology, Nidi Pub. Ltd., Bikaner, 2001. 2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., India, 3. Brunner R.C., Hazardous Waste Incineration, McGraw Hill Inc. 1989.	

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Network Analysis Laboratory

23EE2306	PCC	Network Analysis Laboratory	0-0-2	1 Credit

Teaching Scheme	Examination Scheme
Lecture: -- Tutorial: - Practical: 2 hrs/week	Continuous Assessment -I: 25 Marks Continuous Assessment -II: 25 Marks End Semester Exam: --

Pre-Requisites: Basic Electrical Engineering, Fundamentals of Electrical Circuits.

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

CO1	Solve the equivalent resistance between two points using both star-delta and delta-star conversion methods.
CO2	Solve complex electrical circuits by applying the fundamental theorems, leading to a deeper understanding of circuit behavior and verify by successfully applying the theorems with theoretical results.
CO3	Analyze RL circuits and RC circuits supplied by DC voltage sources with initial values, understanding transient responses
CO4	Solve the complete set of parameters (z, y, ABCD, h) for a given two-port networks, the tie-set and cut-set matrices for oriented graphs, and identify the total number of possible trees in the graph.
CO5	Solve for the total resistance, inductance, or capacitance of an R-L-C series circuit with AC excitation using circuit analysis principles.

List of Experiments:

Minimum 8 experiments should be performed from the following list.

1. Determination of equivalent resistance between two points using star-delta or delta-star conversion
2. Verification of Superposition theorem
3. Verification of Thevinin's Theorem
4. Verification of Reciprocity Theorem
5. Verification of Maximum Power Transfer Theorem
6. Transient analysis of RL circuit supplied by DC Voltage source (Initial values)
7. Transient analysis of RC circuit supplied by DC Voltage source (Initial values)
8. Determination of matrices (tieset and cutset matrices) and also number of possible trees for the oriented graph
9. Determination of z and y parameters of the two port networks
10. Determination of ABCD and h parameters of the two port networks
11. Determination of R or L or C of R-L-C series Circuits with AC excitation.

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Text Books:
1. M.E. Van Valkenberg, Network Analysis, Prentice Hall of India, 3rd Edition, 2000.
2. Charles K Alexander and Mathew N O Sadiku, Fundamentals of Electric Circuits, TMH, 3rd Edition, 2009.
3. Ravish R Singh, Electrical Networks, TMH, New Delhi, 2009.

Reference Books:
1. Hayt, Kemmerly and Durbin, Engineering Circuit Analysis, TMH, 7th Edition, 2010.
2. J. David Irwin and R. Mark Nelms, Basic Engineering Circuit Analysis, John Wiley, 8th Edition, 2006.
3. Roy Choudhury, Networks and Systems, 2nd Ed., New Age Int. Publications, 2006.
4. Joseph A. Edminister, Mahmood Maqvi, Theory and Problems of Electric Circuits, Schaum's Outline Series.
5. Robert L Boylestad, Introductory Circuit Analysis, Pearson Publications.

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Measurement & Instrumentation Laboratory

23EE2307	PCC	Measurement & Instrumentation Laboratory	0-0-2	1 Credit

Teaching Scheme	Examination Scheme
Lecture: -- Tutorial: - Practical: 2 hrs/week	Continuous Assessment -I: 15 Marks Continuous Assessment -II: 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	Identify the different power measurement techniques used in electrical circuits, including the two-wattmeter method for active power measurement and appropriate methods for reactive power measurement.
CO2	Evaluate the precision measurement techniques for resistance, inductance, and capacitance
CO3	Analyze the calibration and maintenance procedures of single-phase energy meters, ensuring accuracy and adherence to industry standards.
CO4	Measure speed, displacement and strain.
CO5	Demonstrate use of digital meters and power analyser for measuring electrical parameters

List of Experiments:

Minimum 8 experiments should be performed from the following list.

1. Measurement of Active Power in three phase's circuit using two wattmeter methods.
2. Measurement of Reactive Power in three phase circuit.
3. Calibration single phase energy meter.
5. Measurement of low resistance using Kelvin double bridge and medium resistance using Wheatstone bridge.
7. Measurement of inductance by using AC bridges.
8. Measurement of capacitance by using Schering Bridge.
9. Measurement of Speed and displacement.
10. Measurement of Strain.
12. Electrical Parameters measurement using digital multimeters and LCR meter.
13. Measurement of Current, Voltage, p.f., Active power, Reactive power by using power analyzer.

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Text Books:

1. R K Rajput, Electrical & Electronic Measurement s and Instrumentation, S Chand Publishing, 2015.
2. Sawhney, A. K., A Course in Electrical and Electronic Measurement and Instrumentation, Dhanpat Rai & Sons, New Delhi.

Reference Books:

1. H.S Kalsi , Electronic Instrumentation, TMH, 2010
2. U. A. Bakshi, A.V. Bakshi, K. A. Bakshi, Electrical Measurements, Technical Publications

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DC Machines & Transformers Laboratory

23EE2308	PCC	DC Machines & Transformers Laboratory	0-0-2	1 Credit

Teaching Scheme	Examination Scheme
Lecture: -- Tutorial: - Practical: 2 hrs/week	Continuous Assessment -I: 15 Marks Continuous Assessment -II: 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	Determine the efficiency of DC machines through various tests including Brake load test, Swinburne's Test, Hopkinson's Test and direct load test.
CO2	Analyze the results effectively by performing O.C.C. of DC Shunt Generator.
CO3	Test the voltage and current relations in Scott connection, open delta connection, and transformers.
CO4	Analyze their findings in a report based on an industrial visit to a Transformer manufacturing unit.

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

1. To perform O.C.C. of DC Shunt Generator.
2. To determine efficiency by direct load test on DC Generator.
3. To determine efficiency by Brake load test on DC Shunt motor.
4. To determine the efficiency of DC Machine at any desired load by Swinburne's Test.
5. To determine the efficiency of the DC Machines by Hopkinson's Test.
6. To determine efficiency by direct load test on single phase transformer.
7. To determine efficiency by Sumpner's Test.
8. To Test voltage and or Current relation in i) Scott connection ii) open delta connection
9. To demonstrate the parallel operation of 3 phase transformer.
10. Report based on Industrial visit to a Transformer manufacturing unit.

Text Books:

1. Bhattacharya S. K, Electrical Machines, Tata McGraw Hill Publications
2. Kothari Nagrath, Electrical Machines, Tata McGraw Hill Publications
3. M. N. Bandopadhyay, Electrical Machines, Tata McGraw Hill Publications

Reference Books:

1. Fitzerland, Electrical Machines, Tata McGraw Hill Publications
2. A. K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai & sons New Delhi
3. K.L. Narang, A Text Book of Electrical Engineering Drawings, Satya Prakashan, New Delhi.
4. A Shanmugasundaram, G. Gangadharan, R. Palani, Electrical Machine Design Data Book, 3rd Edition, Wiely Eastern Ltd., New Delhi.

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SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Mini Project-II

23EE2309	CEP	Mini Project-II	0-0-2	1 Credit

Teaching Scheme	Examination Scheme
Practical: 2 hrs/week	Continuous Assessment-I: - 25 Marks Continuous Assessment-II: -25 Marks

Pre-Requisites: Mini Project

Course Objective: The project is a part of addressing societal and industrial needs. An ideathon is a brief, intense event where students can work on some of the most important problems that the world is facing today. Ideation's are brainstorming events where people with diverse knowledge backgrounds, skill sets and interests get together to predetermined problems, and come up with substantive, innovative and comprehensive solutions. An Ideathon's output might be ideas, a roadmap or an actionable plan. Teams leverage design thinking and cutting-edge techniques to brainstorm and collaborate on potential solutions within a given time frame.

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

CO1	Identify problems based on societal /research needs
CO2	Apply Knowledge and interpersonal skills to solve societal problems in a group.
CO3	Draw the proper inferences from available results through theoretical/ experimental/simulations.
CO4	Analyze the impact of solutions in societal and environmental context for sustainable development.
CO5	Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
CO6	Demonstrate project management principles during project work.

Course Contents:

Week 1: Higher Education and Case Study Pedagogy • Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity. • Allocation of mentor.	[2]
Week 2: Topic Selection • Briefly interact with students to provide hand-holding for topic selection. • Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor. • **Illustrative Examples : Any Industry or Societal Problem** • Finalization of Title.	[2]

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Week 3: Case Study Design/Ideathon: Part 1 • If needed, provide hand-holding to students for finalizing objectives. • Review the objectives of the case study groups. • Identify what can be quantified related to your topic and how. • Decide objectives for your case study. • Continue reading especially recent work specific to your topic.	[2]
Week 4: Case Study Design/Ideathon: Part 2 • Prepare a roadmap of your case study; identify what is to be measured on the field. • Ensure student groups have finalized the objectives.	[2]
Week 5: Survey Design • Prepare a questionnaire and try it out with your group members as mock. • Decide sampling strategy.	[2]
Week 6: Analysis Phase-1 • Students in a group shall understand problem effectively, propose multiple solution. • The students have to work on different approaches and search for the different methodology to solve the problem in consultation with the project guide.	[2]
Week 7 Analysis Phase-2 • The students have to finalize the best methodology to solve the problem in consultation with the project guide. • 25% Presentation has to be conducted by mentor/guide based on above activity.	[2]
Week 8: Analysis-3 • Identify appropriate data visualization tools for your case study. • Analyze the data	[2]
Week 9: Analysis-4 • Identify appropriate data visualization tools for your case study. • Analyze the data	[2]
Week 10: Report writing Part:1 • Prepare an outline of the report and start organizing the write-up for the first draft. • Prepare and submit the first draft of the report to the course coordinator.	[2]
Week 11: Report writing Part:2 • Make necessary corrections if any as per the suggestions of course coordinator. • Submit the final draft of the case study	[2]
Week 12: Final Presentation • 50% Presentation has to be conducted by mentor/guide based on above activity.	[2]

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Multi-Disciplinary Minor-I
Electrical System Planning & Design

23EEMDA1	MDM	Electrical System Planning & Design	2-0-0	2 Credits

Teaching Scheme	Examination Scheme
Lecture: 2 hrs/week Tutorial: -- Practical: --	Continuous Assessment -I: 10 Marks Continuous Assessment -II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basic Electrical Engineering

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

CO1	Explain the fundamental principles and components of electrical systems, including generation, transmission, and distribution.
CO2	Analyze load characteristics and evaluate demand forecasting techniques to estimate electrical loads accurately.
CO3	Apply system analysis techniques to identify power flow, short-circuit, and stability issues, and synthesize optimization strategies for system design.
CO4	Design distribution systems, selecting components and construct operational strategies to ensure reliability and efficiency.
CO5	Evaluate protection systems, synthesize coordination schemes, and justify their application in ensuring system safety.
CO6	Assess sustainable design principles, integrate renewable energy solutions, and justify their implementation for environmentally conscious electrical systems.

Course Contents:

Unit 1: Introduction to Electrical System Planning Overview of electrical system planning and design, Components of electrical systems: generation, transmission, distribution, Factors influencing system planning –load growth, Technological advancements, environmental considerations.	[4]
Unit 2: Load Estimation and Demand Forecasting Load characteristics and classification: peak load, average load, diversity factor, Methods of load estimation: analytical methods, statistical methods, demand forecasting techniques.	[5]
Unit 3: System Analysis and Optimization Basic principles of system analysis: power flow analysis, short-circuit analysis, stability analysis, Optimization techniques in system design: economic dispatch, optimal power flow, reliability-centered maintenance.	[5]
Unit 4: Distribution System Design and Operation Components of distribution systems: substations, feeders, transformers, switchgear, Design considerations for distribution systems: voltage regulation, power factor correction, reliability.	[3]

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Unit 5: Protection and Coordination in Electrical Systems Fundamentals of protection systems: overcurrent protection, differential protection, distance protection, Coordination of protection devices: time-current coordination, zone-selective interlocking.	[3]
Unit 6: Sustainable Design Principles in Electrical Systems Principles of sustainable design: energy efficiency, renewable energy integration, environmental impact mitigation, Green building standards and certifications: LEED, BREEAM, Green Star.	[4]

Text Books:

1. Alexandra von Meier, Electric Power Systems: A Conceptual Introduction, Wiley, 2006
2. Turan Gonen, Electric Power Distribution System Engineering, Mc-Graw Hill Book Company, CRC Press, 2015
3. J. Duncan Glover, Thomas Overbye, and Mulukutla S. Sarma, Power System Analysis and Design, Cengage Learning, 2012.
4. Neil Sclater, John E. Traister, Handbook of Electrical Design Details, Tata Mc-Graw Hill Companies, 2003
5. Ned Mohan, Electric Power Systems: A First Course, John Wiley & Sons, 2012.
6. Badri Ram and D.N. Vishwakarma, Power System Protection and Switchgear, Tata McGraw Hill Education, 2011.

Reference Books:

1. Albert Thumann; Harry Franz, Efficient Electrical Systems Design Handbook, River Publishers,2009
2. B R Gupta, Power System Analysis And Design, S Chand Limited, 2008

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Multi-Disciplinary Minor-I
Introduction to PLC

23EEMDB1	MDM	Introduction to PLC	2-0-0	2 Credits

Teaching Scheme	Examination Scheme
Lecture: 2 hrs/week Tutorial: -- Practical: --	Continuous Assessment -I: 10 Marks Continuous Assessment -II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: --

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

CO1	Define the components and architecture of PLC systems, including CPUs, I/O modules, power supplies, and communication modules.
CO2	Construct basic ladder logic programs using fundamental programming instructions such as contacts, coils, timers, and counters.
CO3	Interpret digital and analog I/O modules, and classify their applications in interfacing with sensors and actuators.
CO4	Execute advanced ladder logic instructions such as arithmetic, comparison, and data manipulation operations.
CO5	Develop human-machine interface (HMI) screens for process visualization and control using HMI software.
CO6	Identify common PLC hardware and software faults, and formulate strategies for fault finding and diagnostics.

Course Contents:

Unit-1: Basics of PLC Invention of PLC, Sustainability of PLC, Definition of PLC, Classifications of PLCs, Role of PLC in Process Automation, Features of a PLC,I/O Devices of PLC,PLC Programming Devices, PLC Selection Criteria, Major PLC Vendors and their Products, Top Five PLC Vendors	[3]
Unit-2: Design and Operation of PLC Architecture of PLC, Central Control Unit of PLC, Functional Modes of PLC,PLC Program Structure and Execution, Programming Devices for PLC, Selection of I/O Modules for PLC — Sourcing and Sinking	[3]
Unit-3: PLC Programming Tools Programming Languages, IEC 61131-3 Structuring Resources, Ladder Diagram, **Variables and Data Types, Register, Timer -** On Delay Timer, Off Delay Timer , Pulse Timer, **Counter -** Up Counter, Down Counter, Up-Down Counter, **Arithmetic Function** Addition (ADD), Subtraction (SUB), Division (DIV), Square Root (SQRT)	[6]

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Unit-4: Advanced PLC Functions Data Handling Functions, MOVE (MV),BLOCK TRANSFER (BT),TABLE AND REGISTER MOVE, Matrix Functions, Analog Signal Handling, PID Control with PLC, Digital Bit Function, Shift Register Function, Sequence Function, Function Chart to IEC 60848	[6]
Unit-5: PLC Communication Necessity for PLC Communication, Data Transmission Formats, Communication with Field Instruments, PLC Protocols **PLC Networking and Interfacing** Remote I/O Systems, Peer-to-Peer Networks, Host Computer Links, Access, Protocol, and Modulation, Functions of LANs, Network Transmission Interfaces.	[3]
Unit-6: Selection and Commissioning of PLC PLC Selection Criteria, Vendor Selection, PLC Commissioning, PLC Auxiliary Functions, Maintenance of PLC, Operational Safety of PLC. **Future of PLC** PLC-Based Automation, PLC and Programmable Automation Controller, Unified Human-Machine Interface, Plug and Play Solution, Wireless Link of PLC, Enterprise Resource Planning with PLC, Industrial Internet of Things and PLC.	[3]

Text / Reference Books:

1. Chanchal Dey, Sunit Kumar Sen, Industrial Automation Technologies, CRC Press, 2020
2. A.K. Gupta and S.K. Arora, Industrial Automation and Control: A Textbook, Laxmi Publications, 2013
3. Frank D. Petruzella, Programmable Logic Controllers, TMH
4. Frank Lamb, Industrial Automation: Hands-On, TMH Education, 2013
5. Stamatios Manesis, George Nikolakopoulos, Introduction to Industrial Automation, CRC Press, 2018

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Multi-Disciplinary Minor-I
Energy Storage Systems

23EEMDC1	MDM	Energy Storage Systems	2-0-0	2 Credits

Teaching Scheme	Examination Scheme
Lecture: 2 hrs/week Tutorial: - Practical: --	Continuous Assessment -I: 10 Marks Continuous Assessment -II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

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

CO1	Define the different types of energy storage technologies and their significance in modern energy management.
CO2	Analyze the characteristics and applications of various electrochemical energy storage technologies, such as batteries and fuel cells.
CO3	Design mechanical energy storage systems, including pumped hydro, compressed air energy storage (CAES), and flywheels, based on specific requirements and constraints..
CO4	Evaluate hydrogen production methods and storage technologies for their efficiency, reliability, and suitability in different applications.
CO5	Explain the principles and applications of thermal energy storage systems, including sensible, latent, and thermochemical storage.
CO6	Synthesize strategies for the integration of energy storage systems with renewable energy sources and grid networks to enhance reliability, stability, and sustainability.

Course Contents:

Unit 1: Introduction to Energy Storage Systems Overview of energy storage systems and their significance in energy management, Types of energy storage technologies: electrochemical, mechanical, chemical, and thermal storage, Comparison of energy storage systems based on capacity, efficiency, response time, and cost	[4]
Unit 2: Electrochemical Energy Storage Principles of electrochemical energy storage: batteries and fuel cells, Types of batteries: lead-acid, lithium-ion, flow batteries, and redox flow batteries, Characteristics, applications, and limitations of different battery technologies.	[4]
Unit 3: Mechanical Energy Storage Principles of chemical energy storage: hydrogen storage and conversion, Hydrogen production methods: electrolysis, steam reforming, and biomass gasification, Hydrogen storage technologies: compression, liquefaction, and solid-state storage.	[4]

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Unit 4: Chemical Energy Storage Advanced ladder logic instructions: arithmetic, comparison, data manipulation, Sequential function chart (SFC) programming for complex control sequences, Introduction to PLC networking and communication protocols (Ethernet/IP, Modbus), Case studies and practical applications of advanced programming techniques.	[4]
Unit 5: Thermal Energy Storage Principles of thermal energy storage: sensible, latent, and thermochemical storage, Types of thermal energy storage systems: water tanks, phase change materials (PCMs), and molten salt storage, Applications of thermal energy storage in solar thermal power plants and district heating systems.	[4]
Unit 6: Integration of Energy Storage Systems Challenges and opportunities in the integration of energy storage systems with renewable energy sources and grid networks, Grid-scale energy storage projects: case studies and real-world examples, Future trends and emerging technologies in energy storage systems.	[4]

Text/ Reference Books:

1. Robert Huggins, Energy Storage: Fundamentals, Materials and Applications, Springer, 2016
2. Michael Sterner, Ingo Stadler, Handbook of Energy Storage: Demand, Technologies, Integration, Springer, 2019
3. Kalaiselvam Sivakumar and Angelos A. Oikonomou, Thermal Energy Storage Technologies for Sustainability: Systems Design, Assessment, and Applications, Elsevier, 2014
4. Nihal Kularatna, Kosala Gunawardane, Energy Storage Devices for Renewable Energy-Based Systems: Rechargeable Batteries and Supercapacitors, Academic Press, 2021
5. Przemyslaw Komarnicki, Pio Lombardi , Zbigniew Styczynski, Electric Energy Storage Systems: Flexibility Options for Smart Grids, Springer, 2017.

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Aptitude Skills-I
(Verbal Ability)

23HSSM01	VEC	Aptitude Skills-I	1-0-0	1 Credit

Teaching Scheme	Examination Scheme
Lecture: 1 hrs/week Tutorial: -- Practical: --	Continuous Assessment -I: 25 Marks Continuous Assessment -II: 25 Marks

Pre-Requisites: Communication Skills

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

CO1	Apply sentence formation rules to spot the error.
CO2	Solve the questions based on the types of tenses.
CO3	Solve the questions based on Direct/Indirect Speech and Passive/active voice and Substitution and Elimination.
CO4	Make use of Proverbs, Idioms and phrases in sentence construction and the vocabulary.

Course Contents:

Unit 1: Speed Math Techniques Structure and Types of Sentences, Conditional Sentences	[3]
Unit 2: Number System Present tense, Past tense, Future tense, Use of Tenses in Sentence forming	[3]
Unit 3: Basic Aptitude Direct and Indirect Speech, Active and Passive Voice, Use of Modal verbs in Sentence Forming, Substitution and Elimination	[3]
Unit 4: Speed- Time- Distance Speed, Time, and Distance, Trains, Boats, Streams, Races	[3]
Text Books : 1. Raymond Murphy, Essential English Grammar with Answers, Murphy 2. R.S. Aggarwal , Objective General English, S Chand Publishing; Revised Edition	
Reference Books: 1. Rao and D,V,Prasada, Wren & Martin High School English Grammar and Composition 2. Murphy, Intermediate English Grammar with Answers, Cambridge University Press, Second Edition.	

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Language Skills- I

23HSSM02	VEC	Language Skills- I	0-0-2	1 Credit

Teaching Scheme	Examination Scheme
Lecture: -- Tutorial: -- Practical: 2 hrs/week	Continuous Assessment -I: 25 Marks Continuous Assessment -II: 25 Marks

Pre-Requisites: Basics of Programming

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

CO1	Develop flowchart and Algorithm to solve the given problem statements.
CO2	Develops programs using Data Types and Operators.
CO3	Make use of Decision Making and Looping Statements to develop conditional programs.
CO4	Make use of Arrays to develop programs in C language.

Course Contents:

Experiments

1. Explain basics of C such as Editing, Compiling, Error Checking, executing, testing and debugging of Programs and Deign Algorithms and Flowcharts.
2. Explain basics of Variable, Data types and operators and develop programs on arithmetic Operators.
3. Develop programs on Conditional, logical and Bitwise Operators.
4. Develop programs on Sizeof () and typecasting operator.
5. Develop programs on increment and decrement operator.
6. Develop programs on simple if and if-else statement.
7. Develop programs on simple if-else ladder and Nested if-else.
8. Develop programs on Switch case statement.
9. Develop programs on For-loop & Nested For-loop.
10. Develop programs on while and do-while loop.
11. Develop programs on one dimensional array.
12. Develop programs on two dimensional array.
13. Develop programs on string handling functions.

Text Books :

1. C Programming Absolute Beginner's Guide, Que Publishing; 3rd Edition
2. Ajay Mittal, Programming in C Practical Approach, Pearson Publication

Reference Books:

1. C: The Complete Reference, McGraw Hill Education; 4th Edition
2. C Programming in easy steps, In Easy Steps Limited, 5th Edition.

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Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

Yadrav (Ichalkaranji), Dist: Kolhapur, Maharashtra-416121

Department: Electrical Engineering

Rev: Course Structure/01/NEP/2023-24

Class: S.Y. B. Tech.

Semester: IV

Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	P	Total Hrs.	CAI	CAII	MSE	ESE	Total	
23EE2401	PCC	AC Machines	3	-	-	3	10	10	30	50	100	3
23EE2402	PCC	Analog & Digital Electronics	2	-	-	2	10	10	30	50	100	2
23EE2403	PCC	Power Systems Analysis	3	-	-	3	10	10	30	50	100	3
23EE2404	PCC	AC Machines Laboratory	-	-	2	2	15	15	-	20	50	1
23EE2405	PCC	Analog & Digital Electronics Laboratory	-	-	2	2	15	15	-	20	50	1
23EE2406	PCC	Power Systems Analysis Laboratory	-	-	2	2	25	25	-	-	50	1
23EE2407	VSEC	Data Analytics using Spread Sheets	-	-	4	4	25	25	-	-	50	2
23EE2408	CEP	Mini Project-III	-	-	2	2	25	25	-	-	50	1
23MILEXX	AEC	Modern Indian Language	2	-	-	2	25	25	-	-	50	2
23EEMDXX	MDM	Multi-Disciplinary Minor- II	3	-	-	3	10	10	30	50	100	3
23OEEE22	OEC	Open Elective-II	3	-	-	3	10	10	30	50	100	3
23HSSM03	VEC	Aptitude Skills-II	1	-	-	1	25	25	-	-	50	Audit
23HSSM04	VEC	Language Skills-II	-	-	2	2	25	25	-	-	50	1
Total			**17**	**-**	**14**	**31**	**230**	**230**	**150**	**290**	**900**	**23**

Multi-Disciplinary Minor Course-II

Electrical System Design **(Basket - A)**	Automation & IOT **(Basket - B)**	Renewable Energy Sources & Grid Integration **(Basket - C)**
Electrical Estimation & Costing (23EEMDA2)	SCADA & HMI (23EEMDB2)	Grid Integration of RES (23EEMDC2)

*Open Elective course will be offered to students of other programs and will not be offered to students of the same program.

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AC Machines

23EE2401	PCC	AC Machines	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week Tutorial: -- Practical: --	Continuous Assessment-I: 10 Marks Continuous Assessment-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basic Electrical Engineering

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

CO1	Demonstrate an understanding of the construction and principle of operation of three-phase induction motors, three-phase alternators and synchronous motors.
CO2	Determine the losses and efficiency of three-phase induction motors.
CO3	Explain the operation of different types of single-phase induction motors, such as split-phase and capacitor start/run motors.
CO4	Assess the characteristics and applications of special AC machines, such as single-phase synchronous motors and hysteresis motors, to understand their unique features and advantages in various industrial applications.

Course Contents:

Unit 1: Three Phase Induction Motor. Construction & types of 3 ph. Induction motors, torque equation, starting torque, running torque (numerical treatment), Factors affecting torque, condition of maximum torque, torque slip characteristics, speed control, necessity of starters and its types, Applications of 3 ph. Induction motors	[6]
Unit 2: Losses & efficiency of 3 phase induction motor. Losses & efficiency of 3 phase induction motor, power flow diagram with numerical treatment, Concept of operation of 3 phase induction motor as induction generator, Double cage induction motor along with its characteristics, cogging & crawling of 3 phase induction motor, Testing of Induction Motors, Circle diagram (Numerical)	[8]
Unit 3: Single phase Motors Double field revolving theory, types of single-phase induction motor (Split phase, capacitor start/run, shaded pole motors),	[4]
Unit 4:Three phase alternator Construction, principle of operation of three phase alternator, EMF equation, Concept of synchronous reactance and synchronous impedance, armature reaction (at unity, lagging	[6]

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zero and leading zero power factor) , alternator on load (resistive, inductive & capacitive). Numerical on voltage regulation, Parallel operation of three phase alternators.	
Unit 5: Synchronous Motor Construction, types, principle of operation of synchronous motor, armature reaction, determination of synchronous reactance, Phasor Diagram of three phase synchronous motor at Unity, lagging and leading power factor, Effect of excitation on power factor and armature current, power angle characteristics, Applications of synchronous Motor.	[6]
Unit 6: Special A.C. Machines Single phase synchronous motors, Permanent magnet AC motors, AC servomotors, Repulsion Motors, Hysteresis Motors, Universal Motors.	[6]
Text Books: 1. S. K. Bhattacharya, Electrical Machines, Tata Mc-Graw-Hill publication III edition 2. B. L. Theraja, Electrical Technology Vol.II, S. Chand Publications 3. I. J. Nagrath, D. P. Kothari, Electrical Machines, Tata Mc-Graw-Hill Publication, 4th Edition.	
Reference Books: 1. A. E. Fitzgerald, Electric Machinery, Mc-Graw Hill Publications, 6th Edition 2. P S Bhimbhra, Electrical Machinery, Khanna Publications 3. Ashfaq Hussain, Electrical Machines, Dhanpat Rai & Sons	

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Analog & Digital Electronics

23EE2402	PCC	Analog & Digital Electronics	2-0-0	2 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 2 hrs/week Tutorial: -- Practical: --	Continuous Assessment-I: 10 Marks Continuous Assessment-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basic Electronics Engineering

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

CO1	Analyze the characteristics and applications of various types of semiconductor diodes, including PN junction, Zener, LED, Schottky, PIN, Tunnel, and Photodiodes, and their roles in circuits such as voltage doublers, clippers, and clampers.
CO2	Explain the principles of transistor biasing, different transistor configurations (CB, CE, CC), and their use as switches, along with the construction and operation principles of MOSFETs.
CO3	Evaluate the performance characteristics and gains of different transistor amplifier configurations (CE, CB, CC) and understand the classification of amplifiers based on biasing conditions, including Class A, Class B, and Class C amplifiers.
CO4	Apply Boolean algebra laws, De-Morgan's Theorem, and Karnaugh maps to simplify Boolean expressions, and design combinational logic circuits such as universal gates, binary adders-subtractors, comparators, decoders-encoders, multiplexers-demultiplexers, and parity generators.
CO5	Analyze the functioning of synchronous and asynchronous counters, and examine data transmission methods in shift registers, including Serial-In Serial-Out (SISO), Serial-In Parallel-Out (SIPO), Parallel-In Serial-Out (PISO), and Parallel-In Parallel-Out (PIPO).
CO6	Comprehend the operation of various types of latches and flip-flops, including SR, JK, D, and T flip-flops, and their applications in digital circuits for storing and transferring data.

Course Contents:

Unit 1: Semiconductor Diode and its applications Semiconductor physics, VI Characteristics of P-N junction diode, Types of diodes and its Applications: Zener diode, LED, Schottky diode, PIN diode, Tunnel diode and Photodiode, Diode Applications, Voltage doublers, Clippers, Clampers.	[3]
Unit 2: Bipolar Junction Transistors Transistor biasing, Biasing rules, Transistor configurations: CB, CE, CC, Transistor as a switch-DC Load line. MOSFET, construction and principle of operation.	[4]

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Unit 3: Transistor Amplifiers Classification of amplifiers, Characteristics and Gains of Transistor amplifier configurations: CE, CB & CC Amplifiers, Amplifier coupling, Amplifier configurations based on biasing condition: Class A, Class B Class C,	[5]
Unit 4: Boolean Algebra and Combinational logic circuits Boolean expressions, Axioms & Laws of Boolean Algebra, De-Morgans Theorem, Reducing Boolean expressions, Minimization of SOP and POS expressions, Karnaugh maps(Numerical) Combinational Logic circuits: Universal Gates, Binary adder-subs tractor, comparators, decoders-encoders, Multiplexers-De-multiplexers, Parity generators	[5]
Unit 5: Shift Registers and Counters Counters: Synchronous and Asynchronous, Up/Down counters, Data transmission in Shift Registers: SISO, SIPO, PISO & PIPO.	[3]
Unit 6: Latches and Flip Flops The SR Latch, Gated Latches (Clocked Flip Flops), Edge Triggered Flip Flops, Types of Flip Flop: SR Flip Flop, JK Flip Flop, D- Flip Flop, T-Flip Flop.	[4]

Text Books:

1. B L Theraja, Basic Electronics Solid State, S Chand Limited.
2. Robert L Boylstead, Electronic Devices and Circuit Theory, Prentice-Hall of India
3. A Anand Kumar, Fundamentals of Digital Circuits, Prentice Hall India Pvt. Limited.

Reference Books:

1. M Morris Mano, Digital Design, Prentice Hall.
2. Charles L Alexander, Mathew N. O. Sadiku, Fundamentals of Electric Circuits, 6th Edition, Tata Mc Graw Hill Publication

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Power System Analysis

23EE2403	PCC	Power System Analysis	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week Tutorial: -- Practical: --	Continuous Assessment-I: 10 Marks Continuous Assessment-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Fundamentals of Electrical Engineering, Basic Circuit Analysis

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

CO1	Explain the typical layout and components of an electrical power system, including hydro, thermal, and nuclear power plants, with emphasis on the construction and function of each component.
CO2	Analyze the structure of electrical power systems, including factors associated with generating stations and concepts such as load curve, load duration curve, base load, and peak load.
CO3	Describe the ratings, features, and field of use of major electrical equipment in power stations, including alternators, transformers, circuit breakers, and protective relays.
CO4	Evaluate the mechanical design aspects of overhead lines, including components, supports, conductor spacing, sag calculation, and effects of ice and wind loading.
CO5	Analyze the resistance, inductance and capacitance of transmission lines.
CO6	Classify transmission lines based on length and voltage levels, and analyse the performance of short and medium transmission lines.

Course Contents:

Unit 1: Electrical Power Generation Overview of Electrical power system, typical layout of an electrical power system, introduction to different sources of energy, construction and working of hydro power plant, thermal power plant, nuclear power plant with block diagram and function of each component.	[5]
Unit 2: Structure of Electrical Power Systems and Tariff **Structure of Electrical Power Systems**: Structure of electrical power system, Different factors associated with generating stations such as Connected load, Maximum demand, Demand factor, Average load, Load factor, Diversity factor, Plant capacity factor, Reserve capacity, Plant use factor, Load curve, Load duration curve, Concept of base load and peak load stations. **Tariff:** Introduction of Tariff, Tariff setting principles, desirable characteristics of tariff,	[6]

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various consumer categories and implemented tariff such as two part tariff, three part tariff(Numerical on two part and three part tariff), Time of day tariff for H.T and L.T industrial and commercial consumers, Introduction to Availability based tariff (ABT), kVAh tariff.	
Unit 3: Major Electrical Equipment's in Power Station & Underground Cables **Major Electrical Equipment's in Power Station**: Descriptive treatment of ratings of various equipment used in power station, Special features, field of use of equipment like alternators, necessity of exciters, various excitation systems such as dc excitation, ac excitation and static excitation systems, Power transformers, voltage regulators, bus-bars, current limiting reactors, circuit breakers, protective relays. Current transformers, potential transformers, Lightning arresters, Earthing switches, isolators, Carrier current equipment's (P.L.C.C), Control panels, battery rooms, metering and other control room equipment in generating station. **Underground Cables**: Construction of Cables, Classification of cables, XLPE cables, Capacitance of single core and three core cable, Dielectric stresses in single core cable, Grading of cables, inter sheath grading, capacitance grading.	[6]
Unit 4: Mechanical Design of Overhead lines and Insulators **Mechanical Design of Overhead lines**: Main components of overhead lines, Various types of line supports, Conductor spacing, Length of span, Calculation of sag for equal and unequal supports and effect of ice and wind loading. **Overhead Line Insulators**: Types of insulators, its construction and their applications such as Pin type, Suspension type, Strain type, Shackle type, bushing, String efficiency, (Numerical on string efficiency and up to four discs only), Methods of improving string efficiency.	[6]
Unit 5: Resistance, Inductance and Capacitance of Transmission Line Resistance of transmission line, Skin effect and proximity effect, Factors responsible for production of these effects. Internal and external flux linkages of single conductor, Inductance of single phase two wire line, Necessity of transposition, Inductance of three phase line with symmetrical and unsymmetrical spacing with transposition, Concept of G.M.R and G.M.D, Inductance of bundled conductors. Electric potential at single charged conductor, Potential at conductor in a group of charged conductors, Capacitance of single phase line, Capacitance of single phase line with effect of earth's surface on electric field, Concept of G.M.R and G.M.D for capacitance calculations, need of transposition for capacitance calculations, Capacitance of three phase line with symmetrical and unsymmetrical spacing with transposition. Capacitance of single circuit and double circuit three phase line with symmetrical and unsymmetrical spacing considering transposition (without considering earth effect).	[8]
Unit 6: Performance of Transmission Line Classification of lines based on length and voltage levels, Performance of short transmission lines with voltage current relationship and phasor diagram, Representation	[5]

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of medium lines as 'Nominal Π' and 'Nominal T' circuits using R,L and C parameters, Ferranti effect, Representation of 'T' and 'Π' models of lines as two port networks, Evaluation and estimation of generalized circuit constants (ABCD) for short and medium lines, Estimation of efficiency and regulation of short and medium lines.	

Text Books:

1. B.M. Weedy, B.J. Cory, N. Jenkins, and Janaka B. Ekanayake, Electric Power Systems, John Wiley & Sons Limited, 2012.
2. Sivanagaraju S, S Satya Narayana, Electric Power Transmission and Distribution, Pearson Education India, 2009.
3. D. P. Kothari and I. J. Nagrath, Power System Engineering, TMH, India, 2007.
4. Singh S. N, Electric Power Generation, Transmission, and Distribution, PHI Learning, 2008
5. D.P. Kothari and I.J. Nagrath, Modern Power System Analysis, TMH, 2011.

Reference Books:

1. C. L. Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd.,
2. Hadi Saadat, Power System Analysis, McGraw-Hill, 2004
3. Colin Bayliss and Brian Hardy, Transmission and Distribution Electrical Engineering, Elsevier Science, 2012
4. Ned Mohan, Tore M. Undeland, and WP. Robbins, Electric Power Systems: A First Course, Wiley, 2012.

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AC Machines Laboratory

23EE2404	PCC	AC Machines Laboratory	0-0-2	1 Credit

Teaching Scheme	Evaluation Scheme
Lecture: -- Tutorial: - Practical: 2 hrs/week	Continuous Assessment-I: 15 Marks Continuous Assessment-II: 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	Demonstrate an understanding of the efficiency and speed regulation of 3-phase squirrel cage induction motors through hands-on direct loading method experiments.
CO2	Analyze the performance of 3-phase slip ring induction motors using direct loading method, and interpret the results using circle diagrams.
CO3	Determine the efficiency and speed regulation of 1-phase induction motors through direct loading method experiments.
CO4	Determine the efficiency of alternators using direct loading method, and analyse voltage regulation using different methods such as EMF & MMF and ZPF.

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

Title of Experiment

1. Field visit to Machine manufacturing industry.
2. Determination of efficiency & speed regulation of 3 phase Squirrel cage induction motor by direct loading method.
3. Determination of efficiency & speed regulation of 3 phase slip ring induction motor by direct loading method.
4. Performance Analysis of 3 Phase SCIM by conducting No Load & Blocked Rotor Test (Circle Diagram).
5. Determination of efficiency & speed regulation of 1 phase induction motor by direct loading method.
6. Determination of efficiency of Alternator by direct loading method.
7. Determination of Voltage regulation of an alternator by EMF & MMF method.
8. Determination of Voltage regulation of an alternator by ZPF method.
9. Demonstrate Parallel operation of three phase alternator.
10. Determination of efficiency of synchronous motor by direct loading.

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Text Books:

1. S. K. Bhattacharya, Electrical Machines, Tata Mc-Graw Hill publication, 3rd Edition
2. B. L. Theraja, Electrical Technology Vol.II, S. Chand Publications
3. I . J. Nagrath, D. P. Kothari, Electrical Machines, Tata Mc-Graw Hill Publication

Reference Books:

1. A. E. Fitzgerald, Electric Machinery, Mc-Graw Hill Publications, 6th Edition.
2. P S Bhimbhra, Electrical Machinery, Khanna Publications.
3. Ashfaq Hussain, Electrical Machines, Dhanpat Rai & Sons.

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Analog & Digital Electronics Laboratory

23EE2405	PCC	Analog & Digital Electronics Laboratory	0-0-2	1 Credit

Teaching Scheme	Evaluation Scheme
Lecture: -- Tutorial: - Practical: 2 hrs/week	Continuous Assessment-I: 15 Marks Continuous Assessment-II: 15 Marks End Semester Exam: 20 Marks

Pre-Requisites: Analog and Digital Electronics, Circuit Analysis

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

CO1	Analyse simple electronic circuits including resistors, capacitors, circuit symbols, CRO, and function generators, to construct and.
CO2	Analyze performance characteristics of various rectifier circuits, including half-wave and full-wave rectifiers with and without filters.
CO3	Implement and verify the functionality of logic gates and combinational circuits, including basic and universal gates, Boolean functions, adders, subtractors, code converters, multiplexers, demultiplexers, encoders, decoders, and counters, to use in digital systems.

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

1. Study of basic electronic components: colour coding of resistors, selection of capacitors, circuit symbols, CRO, Function generator.
2. Design half wave rectifier with and without filter diode.
3. Design full wave rectifier with and without filter using diode.
4. Determine Input and output characteristic of BJT in CE configuration.
5. Determine Input and output characteristic of BJT in CB configuration.
6. Design Darlington emitter follower circuit.
7. P-N junction diode forward and reverse bias characteristics.
8. Zener diode characteristics
9. Study and verification of Basic Gates (AND,OR &NOT)
10. Study and verification of Universal Gates (NAND &NOR)
11. Implementation of the given Boolean function using logic gates
12. Realization of Half Adder& Full Adder/ Half subtractor & Full subtractor using Basic gates
13. Design and implementation of 4 bit binary Adder/ Sub tractor and BCD adder
14. Design and implementation of Multiplexer and De-multiplexer using logic gates.
15. Design and implementation of encoder and decoder using logic gates.
16. Design and implementation of 3-bit synchronous up/down counter

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Text Books:

1. B L Theraja, Basic Electronics Solid State, S Chand Limited.
2. Robert L Boylstead, Electronic Devices and Circuit Theory, Prentice-Hall of India
3. A Anand Kumar, Fundamentals of Digital Circuits, Prentice Hall India Pvt. Limited.

Reference Books:

1. M Morris Mano, Digital Design, Prentice Hall.
2. Charles L Alexander, Mathew N. O. Sadiku, Fundamentals of Electric Circuits, 6th Edition, Tata Mc Graw Hill Publication

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Power System Analysis Laboratory

23EE2406	PCC	Power System Analysis Laboratory	0-0-2	1 Credit

Teaching Scheme	Evaluation Scheme
Lecture: -- Tutorial: - Practical: 2 hrs/week	Continuous Assessment-I: 25 Marks Continuous Assessment-II: 25 Marks

Pre-Requisites: Fundamentals of Electrical Circuits, Basic Electrical Engineering

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

CO1	Explain characteristics of hydroelectric, thermal and nuclear power generation plants by comprehensively understanding their construction, working principles, and component functions.
CO2	Analyze the structure of electrical power systems, including load parameters, generating station factors, and tariff structures, enabling them to effectively integrate available generating stations into load duration curves and apply various tariff setting principles.
CO3	Estimate the performance characteristics of transmission lines.

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

1: Visit to Power Plants - Field Trip to Hydro/Thermal/Nuclear Power Plant. Objective: Understand the layout, components, and functioning of different types of power plants through observation and interaction with plant personnel.

2: Calculation of Load Parameters and Load Duration Curve.
Objective: Calculate and analyze various load parameters such as connected load, maximum demand, load factor, and load duration curve from given data.

3: Visit to Transmission Substation - Identification and Functionality of Major Equipment.
Objective: Identify and describe the major electrical equipment used in a model power station setup, including alternators, transformers, circuit breakers, and control panels.

4: Testing of Underground Cable Characteristics. Objective: Measure and analyze the characteristics of underground cables, including capacitance and dielectric stresses, using experimental setups.

5: Sag Calculation and Mechanical Design of Overhead Lines. Objective: Calculate sag and design overhead lines considering various factors such as conductor spacing, span length, and environmental conditions.

6: Testing of Overhead Lines
Objective: evaluate the string efficiency of overhead line insulators.

7: Measurement of Resistance and Inductance of Transmission Line. Objective: Measure the resistance and inductance of transmission lines.

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8: Measurement of Capacitance of Transmission Line. Objective: Measure the capacitance of transmission lines.
9: Performance Analysis of Short Transmission Lines Objective: Analyze the voltage-current relationship and phasor diagram of short transmission lines to determine efficiency and regulation.
10: Modeling and Analysis of Medium Transmission Lines. Objective: Model medium transmission lines as 'Nominal Π' and 'Nominal T' circuits and estimate efficiency and regulation using ABCD parameters.

Text Books:

1. B.M. Weedy, B.J. Cory, N. Jenkins, and Janaka B. Ekanayake, Electric Power Systems, John Wiley & Sons Limited, 2012.
2. Sivanagaraju S, S Satya Narayana, Electric Power Transmission and Distribution, Pearson Education India, 2009.
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Reference Books:

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4. Ned Mohan, Tore M. Undeland, and WP. Robbins, Electric Power Systems: A First Course, Wiley, 2012.

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Data Analytics using Spread Sheets

23EE2407	VSEC	Data Analytics using Spread Sheets	0-0-4	2 Credits

Teaching Scheme	Evaluation Scheme
Lecture: -- Tutorial: - Practical: 4 hrs/week	Continuous Assessment-I: 25 Marks Continuous Assessment-II: 25 Marks

Pre-Requisites: Nil

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

CO1	Utilize spread sheet software for data analysis, including visualization, statistical analysis, and regression modelling.
CO2	Demonstrate effective data cleaning and pre-processing abilities, ensuring data quality through handling missing values, removing duplicates, and correcting errors.
CO3	Apply advanced spread sheet functions and techniques, such as pivot tables, conditional formatting, and what-if analysis, to derive meaningful insights and create interactive dashboards from complex datasets.

Course Contents:

1) Introduction to Data Analysis Tools:
Familiarize students with spreadsheet software (e.g., Microsoft Excel, Google Sheets). Basic operations: entering data, formatting, sorting, and filtering.

2) Data Visualization Techniques:
Create various types of charts (e.g., bar charts, line graphs, pie charts) to represent data visually. Customize chart elements and styles.

3) Statistical Analysis with Functions:
Use statistical functions (e.g., SUM, AVERAGE, COUNT, MAX, MIN) to analyze datasets. Calculate measures of central tendency and dispersion.

4) Regression Analysis:
Perform linear regression analysis to explore the relationship between two variables. Plot a regression line on a scatter plot and interpret the results.

5) Data Cleaning and Preprocessing:
Clean and preprocess a dataset by removing duplicates, handling missing values, and correcting errors. Use text functions to manipulate and clean textual data.

6) Pivot Tables and Pivot Charts:
Create pivot tables to summarize and analyze large datasets. Generate pivot charts to visualize data trends and patterns.

7) Conditional Formatting and Data Validation:

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Apply conditional formatting rules to highlight specific data points based on predefined criteria. Implement data validation rules to ensure data accuracy and consistency.

8) What-If Analysis:

Utilize scenario manager and goal seeks functionalities to perform what-if analysis. Evaluate the impact of changing input values on calculated results.

9) Data Filtering and Advanced Sorting:

Apply advanced filtering techniques (e.g., text, date, and custom filters) to extract specific subsets of data. Sort data based on multiple criteria and hierarchical levels.

10) Importing External Data:

Import data from external sources (e.g., text files, CSV files) into the spreadsheet. Explore options for data connectivity and integration.

11) Data Analysis with Advanced Functions:

Utilize advanced functions (e.g., VLOOKUP, HLOOKUP, INDEX, MATCH) to perform complex data analysis tasks. Combine functions to extract, manipulate, and analyze data efficiently.

12) Dashboard Creation:

Design a dashboard to present key insights and metrics derived from data analysis.
Incorporate interactive elements (e.g., slicers, dropdown lists) for user-friendly navigation.

Text Books/Reference Books:

1. Kenneth N. Berk, Patrick Carey, Data Analysis with Microsoft Excel, Brooks/Cole, 2010.
2. Robert De Levie, Advanced Excel for Scientific Data Analysis, Oxford University Press, 2004.
3. Stephen L. Nelson, E. C. Nelson, Excel Data Analysis for Dummies, Wiley, 2015.
4. Ash Narayan Sah, Data Analysis Using Microsoft Excel, Excel Books, 2020.
5. Gordon S. Linoff , Data Analysis Using SQL and Excel, Wiley, 2010.
6. Manisha Nigam, Advanced Analytics with Excel 2019: Perform Data Analysis Using Excel Õs Most Popular Features, BPB Publications, 2020.

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Modern Indian Language (Marathi)

23MILE01	AEC	Marathi	2-0-0	2 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 2 hrs/week Tutorial: -- Practical: --	Continuous Assessment-I: 25 Marks Continuous Assessment-II: 25 Marks

Pre-Requisites: Nil

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

CO1	Develop the knowledge of local language/mother tongue and relate the same to daily life and social media.
CO2	Make use of rhetoric and verb to form sentences in Marathi Language.
CO3	Identity Infinitive compounds in the given Marathi sentence.
CO4	Make use of Phrases and proverbs and form a sentence and Solve Prose Assessment/ Summary Writing.
CO5	Model a letter to appropriate end user in Marathi Language.
CO6	Identity writing type of Marathi stanza and write appropriate writing.

Course Contents:

अध्याय 01: भाषा परीचय भाषा आणि व्यक्तिमत्व सहसंबंध, भाषा, जीवनव्यवहार आणि नवमाध्यमे व समाजमाध्यमे, चिन्ह व्यवस्था-विरामचिन्हे, संवाद कौशल्य (तोंडी परीक्षा), सर्वनाम-पुरुषात्मक, दर्शक, संबंधी, प्रश्नार्थक, सामान्य व आत्मवाचक सर्वनाम, विशेषण-गुण विशेषण, संख्या विशेषण, सार्वनामीक विशेषण	[4]
अध्याय 02: मराठी व्याकरण नाम, सर्वनाम, विशेषणे, क्रियापद, क्रियाविशेषण अव्यय, शब्दयोगी अव्यय, उभयान्वयी अव्यय, केवलप्रयोगी अव्यय, विभक्ती व त्याचे प्रकार, काळ व प्रकार	[4]
अध्याय 03: अलंकार व क्रियापदे **अलंकार**-शब्दलांकर- अनुप्रास, यमक, श्लेष उदाहरणे, अर्थालंकार-उपमा, उत्प्रेक्षा, व्यक्तिरेक, अपदुनती, रूपक, व्यक्तिरेक, अननव्य, अतिशयोक्ती उदाहरणे **प्रयोग**-कर्तरी, कर्मणी, भावे **वाक्यप्रकार**-केवल वाक्य, मिश्रवाक्य, संयुक्तवाक्य **समास**-अव्ययीभाव, तत्पुरुष, द्वंद्व, बहूवृही **क्रियापदे**- कर्ता व कर्म, क्रियापदाचे प्रकार- अकर्मक, सकर्मक, उभयविध, संयुक्त, क्रियाविशेषण-कालवाचक, स्थळवाचक, रितीवाचक, संख्यावाचक, प्रश्नार्थक, निषेधार्थक	[4]

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अध्याय 04: वाक्प्रचार व म्हणी व गद्य आकलन/सारांश लेखन अर्थ सांगून वाक्यात उपयोग करणे (कमीत कमी ३० वाक्य प्रचार व म्हणी), गद्य आकलन - अपठित गद्य उतारा व त्यावरील प्रश्न उत्तरे (कमीत कमी ०५ उतारे व त्यावरील प्रश्न उत्तरे), सारांश आकलन	[5]
अध्याय 05: लेखन प्रकार पत्रलेखन व त्याचे प्रकार-निमंत्रण, आभार, अभिनंदन, मागणी, कोटुंबिक, विनंती, तक्रार संधी -स्वरसंधी, व्यंजनसंधी, विसर्गसंधी, वृत्त लेखन, जाहिरात लेखन, कथा लेखन, अहवाल लेखन, आवेदन पत्र, अभिप्रायलेखन	[5]
अध्याय 06: कल्पनाविस्तार व मुलखात कल्पना विस्तार, मुलाखत कौशल्ये, मुलाखतीचे वैशिष्ट्ये, मुलाखतीचे स्वरूप, मुलाखत घेताना घ्यावयाची काळजी, मुलाखत देताना आवश्यक बाबी उदा.आत्मविश्वास, व्यक्तिमत्व विकास, भाषा कौशल्ये इ.	[4]

Text Books:

1. व्यावहारिक मराठी, डॉ.ल.रा.नसिराबादकर, फडके प्रकाशन, कोल्हापूर.
2. व्यावहारिक मराठी, डॉ.लीला गोविलकर, डॉ.जयश्री पाटणकर, स्नेहवर्धन प्रकाशन, पुणे
3. सुगम मराठी व्याकरण लेखन, मो.रा. वाळंबे, नितीन प्रकाशन पुणे

Reference Books:

1. अनिवार्य मराठी व्याकरण, लेखन व आकलन, डॉ. प्रल्हाद लुलेकर, केदार काळवणे, Pearson पब्लिकेशन्स
2. मराठी व इंग्रजी अत्यावश्यक निबंध, प्रा.विजयकुमार वेधपाठक, K'Sagar पब्लिकेशन
3. उपयोजित लेखन, मराठी, प्राची शेंडे, सावली म्हात्रे, टार्गेट पब्लिकेशन्स

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Modern Indian Language (Hindi)

23MILE02	AEC	Hindi	2-0-0	2 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 2 hrs/week Tutorial: -- Practical: --	Continuous Assessment-I: 25 Marks Continuous Assessment-II: 25 Marks

Pre-Requisites: Nil

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

CO1	Develop the awareness of Hindi language and relate the same to daily life and social media.
CO2	Identity Infinitive compounds in the given Hindi sentence.
CO3	Make use of Phrases and proverbs and form a sentence in Hindi language.
CO4	Identity the mistakes in grammar of Hindi language and corrections in it
CO5	Make use of rhetoric to form sentences in Hindi Language
CO6	Illustrate the prose and verse in the given literature

Course Contents:

अध्याय 01: हिंदी भाषा परीचय हिन्दी भाषा और उसका विकास, हिन्दी साहित्य का इतिहास, भाषा के विभिन्न मौखिक भाषा, लिखित भाषा, रूप-वर्णमाला, विराम चिन्ह, शब्द रचना, अर्थ, वाक्य रचना, वर्णो का उच्चारण और वर्गीकरण	[5]
अध्याय 02: समास समास, क्रियाएँ, अनेकार्थी शब्द, विलोम शब्द, पर्यायवाची शब्द,	[5]
अध्याय 03: मुहावरे एवं लोकोक्ति मुहावरे एवं लोकोक्ति, तत्सम एवं तद्भव, देशज, विदेशी, वर्तनी, अर्थबोध	[4]

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अध्याय 04: हिन्दी भाषा में प्रयोग होने वाली अशुद्धियाँ हिन्दी भाषा में प्रयोग होने वाली अशुद्धियाँ, अनेक शब्दों के लिए एक शब्द, रस	[5]
अध्याय 05: अलंकार अलंकार, छन्द, विशेषण और विशेष्य, भाषा-विज्ञान	[4]
अध्याय 06: भाषा-विज्ञान भाषा-विज्ञान, हिन्दी पद्य/गद्य रचना व रचनाकार, संज्ञा से अवयव तक, रिक्त स्थानों की पूर्ति, क्रमबद्धता.	[4]

Text Books:

1. हिंदी व्याकरण- पं कमताप्रसद गुरु, प्रकाशन संस्था, नई दिल्ली
2. हिंदी साहित्यिक का विद्ग्नानिक इतिहास-डॉ गणपतिचंद्र गुप्त, लोकभारती प्रकाशन, नई दिल्ली.

Reference Books:

1. हिंदी भाषा शिक्षण - संपा हिंदी अध्ययन मंडल, सावित्रीबाई फुले पुणे विश्विद्यालय पुणे, राजकमल प्रकाशन

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Mini Project-III

23EE2308	CEP	Mini Project-III	0-0-2	1 Credit

Teaching Scheme	Evaluation Scheme
Lecture: -- Tutorial: -- Practical: 2 Hours/week	Continuous Assessment-I: - 25 Marks Continuous Assessment-II: -25 Marks

Pre-Requisites: Mini Project, Mini Project II

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]

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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.	[2]
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	[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	[2]

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validation processes • Provide detailed reports on test results, issues found, and corrective actions taken.	
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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Multi-Disciplinary Minor Course-II
Electrical Estimation and Costing

23EEMDA2	MDM	Electrical Estimation and Costing	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week Tutorial: -- Practical: --	Continuous Assessment-I: - 10 Marks Continuous Assessment-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

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

CO1	Define the scope and importance of electrical estimation and costing using appropriate terminology.
CO2	Apply diverse factors and demand factors to calculate electrical load for various types of buildings.
CO3	Evaluate material quantities and labor costs for electrical projects using estimation techniques and software tools.
CO4	Estimate costs for electrical installations, including wiring, conduit, and fixtures, applying appropriate costing techniques.
CO5	Prepare project cost estimates, develop cost breakdown structures, and implement budgeting and cost control techniques.
CO6	Analyze real-world electrical projects, present findings, and discuss estimation and costing strategies, demonstrating their understanding through practical application.

Course Contents:

Unit 1: Introduction to Electrical Estimation and Costing Overview of Electrical Estimation and Costing, Importance and Scope in Electrical Engineering Projects, Basic Concepts and Terminologies, Types of Estimates: Preliminary, Detailed, and Final, Factors Influencing Electrical Estimation and Costing.	[6]
Unit 2: Electrical Load Estimation Understanding Electrical Load Characteristics, Methods for Estimating Electrical Load: Diversity Factor, Demand Factor, Load Calculation for Residential, Commercial, and Industrial Buildings, Case Studies and Practical Examples.	[6]
Unit 3: Material and Labour Estimation Identification and Selection of Electrical Materials, Estimation of Material Quantities, Pricing and Costing of Electrical Materials, Estimation of Labour Costs, Costing Techniques and Software Tools for Estimation	[6]
Unit 4: Estimation of Electrical Installation Understanding Electrical Installation Requirements, Methods for Estimating Installation Costs, Factors Affecting Installation Costs: Wiring, Conduit, Fixtures, etc., Estimation of Power Distribution Systems, Case Studies and Practical Exercises.	[6]

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Unit 5: Costing for Electrical Projects Preparation of Project Cost Estimates, Cost Breakdown Structure, Budgeting and Cost Control Techniques, Tendering Process and Bid Preparation, Risk Management in Project Costing.	[6]
Unit 6: Case Studies and Project Work Analysis of Real-World Electrical Projects, Review of Estimation and Costing Techniques, Project Work: Estimation and Costing of Electrical Installation, Presentation of Project Findings and Cost Analysis, Feedback and Discussion.	[6]

Text Books:

1. Wayne J. Del Pico, Electrical Estimating Methods.
2. Paul Rosenberg, Electrical Estimating Pal: The Professional's Choice.
3. Michael Holt, Electrical Estimating Techniques.
4. Robert M. Callahan, Electrical Cost Estimating.
5. J.B. Gupta, Electrical Installation Estimating and Costing.

Reference Books:

1. Steven J. Peterson and Frank R. Dagostino, Estimating in Building Construction.
2. Leonard P. Toenjes, Construction Cost Estimating: Process and Practices.
3. S.L. Uppal, Electrical Estimating and Costing.
4. Edward J. Tyler, Estimating Electrical Construction.
5. Mark C. Tyler, Practical Electrical Estimating.

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Multi-Disciplinary Minor Course-II
SCADA & HMI

23EEMDB2	MDM	SCADA & HMI	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week Tutorial: -- Practical: --	Continuous Assessment-I: - 10 Marks Continuous Assessment-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: --

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

CO1	Define the key concepts of SCADA and HMI systems, summarize their evolution, and explain their significance in industrial automation.
CO2	Analyze SCADA hardware and software components, differentiate between various data acquisition devices, and classify communication protocols used in SCADA systems.
CO3	Design graphical user interfaces (GUIs) for HMI systems, integrate data visualization techniques, and create alarm management systems using HMI software tools.
CO4	Configure SCADA servers and clients, implement database integration for data management, and evaluate security measures for SCADA systems.
CO5	Analyze the role of SCADA in power generation, transmission, and distribution, apply fault detection techniques, and assess energy management strategies using SCADA systems.
CO6	Evaluate big data analytics for predictive maintenance, integration of SCADA with emerging technologies such as IoT, cyber security challenges and solutions in SCADA systems.

Course Contents:

Unit 1: Introduction to SCADA and HMI Systems Overview of SCADA and HMI Systems, Evolution and Importance in Industrial Automation, Basic Concepts and Components, SCADA Architecture and Communication Protocols, HMI Design Principles and User Interface	[6]
Unit 2: SCADA System Architecture Understanding SCADA Hardware and Software Components, Data Acquisition and Control Devices, PLC Integration with SCADA Systems, Remote Terminal Units (RTUs) and Communication Networks, Case Studies and Practical Examples.	[6]
Unit 3: HMI Development and Programming HMI Software Tools and Platforms, Designing Graphical User Interfaces (GUIs), Data Visualization and Trend Analysis, Alarm Management and Event Handling, Simulation and Testing Techniques	[6]
Unit 4: SCADA System Configuration and Deployment Configuration of SCADA Servers and Clients, Database Integration and Data Management, SCADA System Security and Access Control, Redundancy and Fault Tolerance, Site	[6]

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Preparation and Installation Guidelines.	
Unit 5: SCADA Applications in Electrical Systems SCADA Applications in Power Generation, Transmission, and Distribution, Monitoring and Control of Electrical Grids, Fault Detection and Diagnosis, Energy Management and Optimization, Case Studies and Real-World Applications.	[6]
Unit 6: Advanced Topics and Emerging Trends SCADA in Smart Grids and Renewable Energy Systems, Integration with Internet of Things (IoT) Technologies, Big Data Analytics and Predictive Maintenance, Cyber security Challenges and Solutions, Future Directions and Career Opportunities.	[6]
Text Books: 1. Manish Jain, SCADA System: Application and Basics 2. Patrice Micouin, Human-Machine Interface (HMI) Design Principles for Industrial Applications 3. Stuart A. Boyer, SCADA: Supervisory Control and Data Acquisition 4. Alireza Mousavi, Introduction to SCADA Systems 5. Vijay K. Garg, HMI/SCADA Software Solutions	
Reference Books: 1. Robert Radvanovsky and Jacob Brodsky, SCADA: Industrial Control Systems Security 2. David Bailey and Edwin Wright, Practical SCADA for Industry 3. Mohinder S. Grewal, SCADA: Supervisory Control and Data Acquisition Systems 4. Sami M. Khuri, Human Machine Interface (HMI) Technologies in Industrial Applications 5. Gregory S. McMillan, SCADA and Me: A Book for Children and Management	

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Multi-Disciplinary Minor Course-II
Grid Integration of RES

23EEMDC2	MDM	Grid Integration of RES	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week Tutorial: -- Practical: --	Continuous Assessment-I: - 10 Marks Continuous Assessment-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

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

CO1	Summarize the different types of renewable energy sources and their significance in the context of grid integration, using appropriate terminology.
CO2	Analyze grid codes and technical standards, apply interconnection protocols, and assess the impact of RES integration on grid stability using quantitative methods.
CO3	Design power electronic converters for RES integration, evaluate control strategies for grid interfacing, and synthesize simulation models for power electronics systems.
CO4	Demonstrate proficiency in modeling solar photovoltaic systems, implement maximum power point tracking (MPPT) techniques, and evaluate the performance of PV systems in grid-connected applications.
CO5	Analyze wind turbine models, design control strategies for wind energy integration, and assess the impact of wind integration on grid stability through experimental validation.
CO6	Critique energy storage systems for RES integration, propose solutions for demand response and smart grid integration, and formulate research proposals for addressing future challenges in grid integration.

Course Contents:

Unit 1: Introduction to Renewable Energy Sources (RES) and Grid Integration Overview of Renewable Energy Sources: Solar, Wind, Hydro, Biomass, etc., Importance and Benefits of RES Integration into the Grid, Challenges and Opportunities in Grid Integration Basic Concepts of Grid Operation and Control, Policy and Regulatory Framework for RES Integration	[6]
Unit 2: Grid Connection Requirements for RES Grid Code Compliance and Technical Standards, Interconnection Protocols and Grid Connection Procedures, Reactive Power Management and Voltage Control, Impact of RES Integration on Grid Stability and Reliability, Case Studies and Best Practices in Grid Connection.	[6]
Unit 3: Power Electronics for RES Integration	[6]

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Introduction to Power Electronic Converters: Inverters, Converters, Controllers, Role of Power Electronics in RES Integration: Power Quality, Frequency Control, Grid Interfacing Techniques: Grid-Forming and Grid-Following Control, Control Strategies for RES Converters: MPPT, Voltage Regulation, Simulation and Design of Power Electronics Systems	
Unit 4: Grid Integration of Solar Photovoltaic Systems Grid Connection Requirements for Solar PV Systems, PV System Modeling and Simulation, Maximum Power Point Tracking (MPPT) Techniques, Impact of PV Integration on Grid Stability and Operation, Case Studies and Practical Examples	[6]
Unit 5: Grid Integration of Wind Energy Systems Grid Connection Requirements for Wind Turbines, Wind Turbine Modeling and Control, Wind Farm Configuration and Control Strategies, Impact of Wind Integration on Grid Stability and Power Quality, Case Studies and Real-World Applications	[6]
Unit 6: Advanced Topics in Grid Integration of RES Energy Storage Systems for RES Integration, Demand Response and Smart Grid Technologies, Microgrid Integration of RES, Forecasting Techniques for RES Output, Future Trends and Research Directions in Grid Integration	[6]

Text Books:

1. Lawrence Jones, Grid Integration of Renewable Energy Sources
2. Lawrence E. Jones, Renewable Energy Integration: Practical Management of Variability, Uncertainty, and Flexibility in Power Grids
3. Hemant Singh Sikarwar, Power Electronics for Renewable and Distributed Energy Systems: A Sourcebook of Topologies, Control, and Integration
4. Parimita Mohanty, Solar Photovoltaic System Applications: A Guidebook for Off-Grid Electrification
5. Mohd. Hasan Ali, Wind Energy Systems: Solutions for Power Quality and Stabilization

Reference Books:

1. Ali Sayigh, Renewable Energy Systems: Advanced Conversion Technologies and Applications
2. Stuart Borlase, Smart Grids: Advanced Technologies and Solutions
3. Ningbo Wang, Grid Integration and Dynamic Impact of Wind Energy
4. Pengwei Du, Energy Storage for Smart Grids: Planning and Operation for Renewable and Variable Energy Resources
5. Nikos Hatziargyriou, Microgrids: Design, Operation, Control, and Protection

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Aptitude Skills-II
(Numerical Ability)

23HSSM03	VEC	Aptitude Skills-I	1-0-0	Audit

Teaching Scheme	Evaluation Scheme
Lecture: 1 hrs/week Tutorial: -- Practical: --	Continuous Assessment-I: 25 Marks Continuous Assessment-II: 25 Marks

Pre-Requisites: Communication Skills

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

CO1	Make use of multiplications, squares, square roots, cubes and cube roots to solve aptitude problems.
CO2	Solve questions based on Number system.
CO3	Solve questions based on percentage, average, ratio, proportion, Speed, Time and Distance.
CO4	Solve questions based on Profit & Loss and mensuration.

Course Contents:

Unit 1: Speed Math Techniques Multiplication, Squares, Square roots, Cubes, Cube roots	[3]
Unit 2: Number System Types of Number System, Last Digit Method, BODMAS Calculation, HCF and LCM, Progressions	[3]
Unit 3: Basic Aptitude Percentage, Average, Ratio and Proportion, Fraction, Partnership **Speed- Time- Distance** Speed, Time, and Distance, Trains, Boats, Streams, Races	[3]
Unit 4: Business Aptitude Profit & Loss, Simple Interest, Compound Interest **Geometry and Venn Diagram** 2D and 3D Mensuration, Venn diagram	[3]

Text Books :

1. Arun Shrama , Quantitative aptitude for CAT.
2. RS Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S. Chand Publisher, 2016
3. RS Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Publisher, 2016.

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Reference Books:

1. Rajesh Verma, Fast Track Objective Arithmetic Paperback, 2018
2. Arun Sharma, Teach Yourself Quantitative Aptitude.
3. Dinesh Khattar, The Pearson Guide to Quantitative Aptitude for Competitive Examination.

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Language Skills- II

23HSSM04	VEC	Language Skills- II	0-0-2	1 Credit

Teaching Scheme	Evaluation Scheme
Lecture: -- Tutorial: -- Practical: 2 hrs/week	Continuous Assessment-I: 25 Marks Continuous Assessment-II: 25 Marks

Pre-Requisites: Communication Skills, Language Skills- I

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

CO1	Develop programs using Functions.
CO2	Make use of Structures & Union to develop programs in C language
CO3	Make use of Pointers to develop programs in C language
CO4	Develop programs to perform various operations on files using File Handling.

Course Contents:

Experiments

1. Develop programs on using different built-in functions.
2. Develop programs on using function without argument and without return category.
3. Develop programs on using function with argument and without return category.
4. Develop programs on using function without argument and with return category.
5. Develop programs on using function with argument and with return category.
6. Develop programs using more than one used defined functions
7. Develop programs on recursion
8. Develop programs on Structure using various entities and size of structure
9. Develop programs on array of structure
10. Develop programs on structures and functions and compare structure and union.
11. Develop programs to display different data type of data and their addresses using pointer.
12. Develop programs on pointer to array, pointer to structure, pointer to functions and pointer expressions.
13. Develop program to read, write and append data from a file.

Text Books:

1. C Programming Absolute Beginner's Guide, Que Publishing; 3rd Edition
2. Ajay Mittal, Programming in C Practical Approach, Pearson Publication

Reference Books:

1. C: The Complete Reference, McGraw Hill Education; 4th Edition
2. C Programming in easy steps, In Easy Steps Limited, 5th Edition.

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