Mandsaur University

Diploma Electrical Engineering

Semester-IV

PCDEE0110A Electrical & Electronics Measurement & Measuring Instruments

L-2 T-1 P-2 C-4

Course Objectives

- To identify the various parameters that are measurable in electronic instrumentation
- To employ appropriate instruments to measure given sets of parameters
- To practice the construction of testing and measuring set up for electronic systems
- To have a deep understanding about instrumentation concepts which can be applied to Control systems
- To use relevant measuring instrument in different electrical applications

Course Outcomes (COs)

1. Remember various types of electronic instrument suitable for specific measurement
2. Understand various errors present in measuring instruments
3. Apply construction, working principle and types of oscilloscopes
4. Analyze different types of signal generators and analyzers, their construction and operation.
5. Evaluate and describe the working principle, selection criteria and applications of various transducers used in measurement systems

Articulation Matrix

(Program Articulation Matrix is formed by the strength of correlation of COs with POs and PSOs. The strength of correlation is indicated as 3 for substantial (high), 2 for moderate (medium) correlation, and 1 for slight (low) correlation)

CO/PO/ PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	1	1	-	-	1	1	-
CO2	3	2	1	2	-	1	1	-	-	2	2	-
CO3	2	3	1	1	-	1	1	-	-	2	2	-
CO4	2	3	1	2	-	1	1	-	-	1	1	-
CO5	3	3	1	1	-	1	1	-	-	1	1	-

High-3Medium-2Low-1

Unit I Measuring System **9 Hours**

Elements of a Measuring System, Block Diagram of System Configuration, Performance, Standards, Time Lag, Error, Distortion and Distortion Meters, Noise and Noise Factor

Unit II Sensors & Transducers **9 Hours**

Definition and Classification, Mechanical Devices as Primary Detectors, Characteristic & Choice of Transducers ,Electrical Transducers, Advantages of Electric Transducers, Active and Passive Transducers, Classification, Resistive, Inductive and Capacitive Transducers, Potentiometric, Metallic and Semiconductor Strain Gauges, Gauge Factor, Types, Material Used and Applications Thermistor, RTD, Inductive, LVDT Thermocouples, Piezo-Electric Transducers Opto-Electronic Transducers such as Photo Voltaic, Photo Conductive, and Photo Conductive Cells, Constructional Details, Characteristics and Applications

Unit III Signal Conditioners **9 Hours**

Purpose of Signal Conditioning, Classification, Input Modifier, Operational Amplifiers Circuits used in Instrumentation, D.C. Amplifier, Chopper Amplifier. Instrumentation Amplifier, Characteristics, Three Amplifier Configuration. A/D and D/A Converters

Unit IV Data Acquisition System **9 Hours**

Introduction data Acquisition System, Generalized DAS, Single and Multi Channel DAS, Data Loggers, Special Encoders

Unit V Display Devices and Recorders **9Hours**

Digital Display System and Indicators like CRT, Seven Segment LED, LED, LCD. Analog and Digital

Recorders, Strip and Circular Chart Recorder and Magnetic Tape Recorder, X-Y Plotters Ultraviolet Recorders, Digital Tape Recorder.

Total: 45Hours

PRAC TICALS:

1. Measurement of Voltage, Current, and Resistance Using Multimeter
2. Measurement of Resistance Using Wheatstone's Bridge
3. Measurement of Load/Weight Using Strain Gauge and Cantilever
4. Measurement of Linear Displacement by LVDT and Draw its Characteristics
5. Measurement of Temperature by Thermocouple
6. Measurement of Temperature Using Resistance Thermometer
7. Measurement of Temperature Using LM35
8. Measurement of Pressure Using LVDT and Diaphragm Gauge
9. Study and Use of Data Conversion Using Analog to Digital Conversion
10. Study and Use of Data Conversion Using Digital to Analog Conversion
11. Measurement of pH Value Using pH Meter
12. Measurement of Humidity by Hygrometer
13. Study and Flow Measurement Using Electromagnetic Flow Meter
14. Study of Time Division and Frequency Division Multiplexing
15. Measurement of Liquid Level by Resistive/Capacitive Transducer

Total: 75Hours

References:

1. A.K.Sawhney (2004), A Coursein Elect. & Electronic Measurement and Instrumentation, Dhapat Rai & Co
2. Golding & Widis (2006), Electrical Measurement and Measurement Instrument, Wheelar Books
3. H.S.Kalsi(2001),Electronic Instruments, Tata Mc-Graw Hill
4. Carr, Elements of Electronic Instrumentation and Measurement (2002), Pearson Education
5. D.Patranabis(2005), Sensors & Transducers, PHI

List of e-Learning Resources:

1. https://nptel.ac.in/courses/108/105/108105153/

Subject Expert **Academic Coordinator** **HoD** **Appointed Senior Faculty by DoAA**

Mandsaur University

Diploma Electrical Engineering

Semester-IV

L-0 T-0 P-4 C-2

PCDEE0120A Electrical CAD Lab

Course Objectives

- To build sound practical knowledge in Electrical CAD
- To acquire practical skills in creating/ designing electrical instrument and their connections by software-based techniques

Course Outcomes (COs)

1. Apply software-based engineering tools and techniques for electrical instrument and their connections
2. Analyze the designs of the motor windings types
3. Design the starters and its connections

Articulation Matrix

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CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	1	1	-	2	1	1	-	-	1	1	1
CO2	3	1	1	-	2	1	-	-	-	1	-	1
CO3	2	1	2	-	2	1	1	-	-	1	1	1

High-3 Medium-2 Low-1

PRACTICAL

1. Study the introduction of E-CAD.
2. Draw the LAP winding connections of DC machine using E-CAD
3. Draw the starter of three phase Induction motor using E-CAD
4. Draw the internal connection on IC 555 using E-CAD
5. Draw the single line diagram of transmission and distribution system using E-CAD
6. Draw the Pin type insulator of transmission system using E-CAD
7. Draw a DC motor and alternator set using E-CAD
8. Draw the Direct On Line (DOL) starter using E-CAD
9. Draw the cross linked polyethylene (XLPE) Cable using E-CAD
10. Draw the Un-bifurcated winding using E-CAD

Total: 60 Hours

Subject Expert **Academic Coordinator** **HoD** **Appointed Senior Faculty by DoAA**

Mandsaur University

Diploma Electrical Engineering
Semester-IV

L-2 T-1 P-0 C-3

PCDEE0700A Energy Conservation and Audit

Course Objectives:

- To identify the energy losses and wastage.
- To suggest the energy conservation techniques in various sectors.
- To find the opportunity for saving in energy consumption through tariff structure.
- To prepare energy audit report.

Course Outcomes:

The students will be able to

1. Understand the demand supply gap of energy in Indian scenario.
2. Apply energy audit of an industry/Organization.
3. Analyze appropriate energy conservation method to reduce the wastage of energy
4. Evaluate the energy flow diagram of an industry and identify the energy wasted or a waste stream.

Articulation Matrix

(Program Articulation Matrix is formed by the strength of correlation of COs with POs and PSOs. The strength of correlation is indicated as 3 for substantial (high), 2 for moderate (medium) correlation, and 1 for slight (low) correlation)

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	2	-	2	-	-	-	-	1	-	1
CO2	3	2	1	-	-	-	1	-	-	-	-	-
CO3	2	1	3	-	1	-	-	-	-	1	1	-
CO4	2	2	1	-	-	-	1	-	1	-	-	-
CO5	1	2	2	-	-	-	-	-	-	-	-	1

High-3 Medium-2 Low-1

Unit-I Energy Conservation in Lighting system **12 Hours**

Introduction to Energy Conservation - Present energy scenario, Meaning of term Energy Conservation, Need of energy conservation, , Energy Conservation Act – 2003, Functions of Government Organization (NPC, MNRE, BEE, MEDA).

Energy Conservation in Lighting System - Basic terms used in lighting system (Illumination), Recommended Luminance levels, Procedure for assessing existing Lighting system in a facility. Energy Conservation techniques in lighting system - By replacing Lamp sources, Using energy efficient luminaries, Using light controlled gears, By installation of separate transformer / servo stabilizer for Lighting, Periodic survey and adequate maintenance programs, Energy Conservation techniques in fans, Electronic regulators.

Unit-II Energy Conservation techniques in Electrical Motors **12 Hours**

Construction, Power flow and working of Induction motor. Factors governing the selection of Induction motor. Need for energy conservation in Induction motor. Various energy conservation techniques in Induction motor - improving power quality, motor survey, matching motor, minimizing the idle, Redundant running of motor, operating in star mode, rewinding of motor, improving mechanical power and transmission Efficiency. Energy Efficient motors - Comparison with conventional Induction motor

Unit-III Energy Conservation techniques in transformer **12 Hours**

Need of energy conservation in transformer. Methods (related to material, design) to improve the performance of transformer.

Energy conservation techniques related to transformer - Loading sharing, Parallel operation, Isolating techniques. Energy efficient transformers - Amorphous transformers, Epoxy Resin cast transformer (Dry type of transformer), Periodic maintenance.

Unit-IV Tariff And Energy Conservation Equipments **12 Hours**

Types of tariff structure, Terms involved in tariff, Specific tariff: - Time-off-day tariff, Peak-off-day tariff, Power factor tariff, Maximum Demand tariff, Load factor tariff. Application of tariff system to reduce energy bill, Simple numerical based on power factor and load factor tariff.

Energy conservation equipment's - Energy conservation equipment related to Lighting system - Centralized Control Equipment (Microprocessor based), Occupancy sensors/Motion Detectors, Control gears: Dimmers, Regulators, and Stabilizers). Energy conservation equipment related to electrical motors - Construction, working and advantages of each energy conservation Equipment listed below - Soft starter: For induction motors, Power Factor Controller, Static capacitor, Automatic star delta starter, Variable Frequency Drives.

Unit-V Energy Audit **12 Hours**

Energy flow diagrams and its significance, Energy audit instruments and their use, Prepare questionnaire for energy audit projects, ABC analysis and its advantages referred to energy audit projects, Energy Audit procedure (walk through audit and detailed audit), Calculation of simple payback period (Simple numerical)

Total 60 Hours

Reference Books:

1. S. Sivanagraju, M. Balasubba Reddy, D. Srilatha - Generation And Utilization Of Electrical Energy, Pearson, New Delhi
2. P. H. Henderson, India - The Energy Sector, University Press
3. W. C. Turner, Energy Management Handbook, Wiley Press
4. B. G. Desai, J. S. Rana, A. V. Dinesh, R. Paraman - Efficient Use And Management Of Electricity In Industry, Devki Energy Consultancy PVT. Ltd.

List of e-Learning Resources:

1. https://nptel.ac.in/
2. https://www.coursera.org/

Subject Expert	**Academic Coordinator**	**HoD**	**Appointed Senior Faculty by DoAA**

Mandsaur University

Diploma Electrical Engineering

Semester-IV

L-2 T-1 P-2 C-4

PCDEE0800A Electrical Machine- II

Course Objectives

- To remember basics of DC machines and fundamental concepts of cause and cure of armature reaction in DC machines
- To understand the operations of DC machines and performing of tests on DC motors for efficiency calculations
- To apply basics fundamental of synchronous motor in its working and its uses as a power factor correcting device
- To analyze the construction according to working, circuit, phasor diagrams of Synchronous machine
- To create the concepts about operation of alternator and its methods of voltage regulation

Course Outcomes (COs)

1. Understand the DC machine and its commutation technique, armature reaction problem and improvements
2. Apply the starting of DC motors, losses calculations with the help of tests performed on the motor
3. Analyze the synchronous machine on the basis of construction, winding arrangements, impact of armature reaction on the same
4. Analyze the concept of synchronization, load sharing of alternators and few methods to define the voltage regulation of alternators
5. Analyze the synchronous motor as a power factor correcting device on the basis of performance characteristics of V and inverted V curves and also the losses to improve the efficiency

Articulation Matrix

(Program Articulation Matrix is formed by the strength of correlation of COs with POs and PSOs. The strength of correlation is indicated as 3 for substantial (high), 2 for moderate (medium) correlation, and 1 for slight (low) correlation)

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	1	-	-	2	1	1
CO2	2	2	1	-	-	1	-	-	-	1	-	-
CO3	2	3	1	-	-	-	1	-	-	1	1	1
CO4	2	1	-	-	-	1	-	-	-	-	1	-
CO5	2	1	-	-	-	1	-	-	-	-	-	1

High-3 Medium-2 Low-1

UNIT I:D.C. Machine-I **9 Hours**

Working principle, construction of DC machines, types of DC machines and method of excitation, Lap and Wave windings, e.m.f. equations, armature reaction, commutation, causes of bad commutation, methods of improving commutation, basic performance of DC generators and their performance characteristics

UNIT II: D.C. Machine-II **9 Hours**

Basic operation of DC motors, torque equation; operating characteristics of DC motors, 2-point, 3-point and 4-point starters of DC motors, speed control methods: field and armature control, braking, testing: Hopkinson's test, estimation of losses and efficiency

UNIT III: Synchronous Machine-I **9 Hours**

Constructional features, excitation system including brushless excitation; polyphase distributive winding, synchronous generator- generated e.m.f., circuit model and phasor diagram, armature reaction

UNIT IV: Synchronous Machine-II **9 Hours**

Salient pole machine- two reaction theory, analysis of phasor diagram, power angle characteristics, parallel operation of alternators - synchronization and load division, Synchroscopes and phase sequence indicator, synchronous reactance and impedance, equivalent circuit of alternator. Voltage regulation of alternators using synchronous impedance, mmf and zpf method

UNIT V: Synchronous Machine-III **9 Hours**

Synchronous motor - operating principle, circuit model, operating characteristics, V-curves and inverted V-curves, synchronous motors as power factor correcting device, super synchronous, efficiency and losses, starting methods of synchronous motors

Total: 45 Hours

PRACTICALS

11. Study Constructional features of DC Motor
12. Study the 2- Point and 3- Point of DC Motor
13. Study the 4- Point Starter of DC Motor
14. Perform armature control method of speed control of separately excited D. C. Motor
15. Perform field flux control method of speed control of shunt D. C. Motor
16. Study Commutation Process and Slip Ring of DC Machine
17. Perform Hopkinson Test on a DC Generator and Motor Set
18. Study Constructional Features of Synchronous Machine
19. Study the Synchro scopes of Synchronous Machine
20. Perform V Curve Method on Synchronous Motor

Total: 75 Hours

Reference(s)

1. M.G. Say, Performance & Design of AC Machines, CBS Publishers & Distributors, Delhi, 3rd Edition
2. A.E. Clayton & N.N. Nancock, the Performance & Design of DC Machines CBS Publications & Distributors, Delhi, 3rd Edition
3. P.S. Bhimbra, Electrical Machinery, Khanna Pub
4. P.S. Bhimbra, Generalized Theory of Electrical Machines, Khanna publishers, Delhi
5. Ashfaq Husain, Electric Machines, Dhanpat Rai, New Delhi
6. I.J. Nagrath& D.P. Kothari, Electric Machines, Tata McGraw Hill, New Delhi

List of e-Learning Resources:

3. https://onlinecourses.nptel.ac.in/noc23_ee55/preview
4. https://www.coursera.org/learn/motors-circuits-design

Subject Expert **Academic Coordinator** **HoD** **Appointed Senior Faculty by DoAA**

Mandsaur University

Diploma: Electrical Engineering
Semester-IV

L-2 T-1 P-2 C-4

PCDEE0900A Power Plant Engineering

Course Objectives:

- To basic knowledge of Different types of Power Plants, site selection criteria of each one of them.
- To understanding of Thermal Power Plant Operation, turbine governing, different types of high-pressure boilers including supercritical and supercharged boilers, Fluidized bed combustion systems.
- To basic knowledge of Different types of Nuclear power plants including Pressurized water reactor, Boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.
- To basic knowledge of Diesel & Gas Power Plants, site selection criteria of each one of them.
- To understanding of Power Plant Economics.

Course Outcomes (COs):

1. Understand the components, principles and working of non-conventional power plant.
2. Apply the various components of steam power plant and the factors influencing the site selection for the plant.
3. Analyze the working of various components of diesel power plant and compare it with steam power plant.
4. Evaluate the components, principles and working of nuclear power plant.
5. Create the economics involved in Power Plant and identify the factors related to selection of plant

Articulation Matrix:

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CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	2	2	-	-	-	-	-	-		-	2
CO2	2	2	2	-	-	-	-	-	-	1	2	2
CO3	2	2	1	-	-	-	-	-	-	1	2	-
CO4	2	1	-	-	-	-	-	-	-	-	1	-
CO5	2	1	-	-	-	-	-	-	-	-	2	1

High-3 Medium-2 Low-1

Unit I Power from Renewable Energy **9 Hours**

Schematic Arrangement, Advantages and Disadvantages, Choice of Site Constituents of Hydro Power Plant, Hydro Turbine. Environmental Aspects for Selecting the Sites and Locations of Hydro Power Stations, Principle, Construction and Working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Bio-Gas and Fuel Cell Power Systems.

Unit II Coal Based Thermal Power Plants **9 Hours**

Rankine Cycle – Improvisations, Layout of Modern Coal Power Plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of Thermal Power Plants – Fuel and Ash Handling, Draught System, Feed Water Treatment. Binary Cycles and Co-Generation Systems.

Unit III Diesel, Gas Turbine and Combined Cycle Power Plants **9 Hours**

Otto, Diesel, Dual & Brayton Cycle – Analysis & Optimization. Components of Diesel and Gas Turbine Power Plants. Combined Cycle Power Plants. Integrated Gasifiers Based Combined Cycle Systems.

Unit IV Nuclear Power Plants **9 Hours**

Basics of Nuclear Engineering, Layout and Subsystems of Nuclear Power Plants, Working of Nuclear Reactors: Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), Canada Deuterium-Uranium Reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety Measures for Nuclear Power Plants.

Unit V Power Plant Economics **9 Hours**

Load Curves, Base Load, Peak Load, Load Factor, Demand Factor, Diversity Factor, Capacity Factor, Utilization Factor, Cost of Electricity, Capital Cost, Fuel and Operation Cost.

Total: 45 Hours

PRACTICALS:

1. To Study the renewable (Solar) energy source.
2. To Study the Hydro Power Station.
3. To Study the Nuclear Power Station.
4. To Study the Thermal Power Station.
5. To Study of Diesel Power Plant.
6. To Study the Bio-Gas Plant.
7. To Study the Wind Power Plant.
8. To Study the working of Impulse and Reaction steam turbines.
9. To study cooling tower and find its efficiency.
10. To study Low pressures Boiler and their mountings and accessories.
11. To study high pressure boilers and their accessories and mountings.
12. To Study the Super-heater, Air-preheater, Economizer, Condenser.

Total: 75 Hours

References:

1. Power Generation Technology- Dr.V.K.Sethi, Sudit Publication
2. Thermal Power Technology - Dr.V.K.Sethi, Sudit Publication
3. Generation, Distribution and Utilization of Electrical Energy by C.L. Wadhwa, New Age International.
4. Elements of Power System Analysis- William Stevenson Mc-Graw Hill
5. Modern Power System Analysis- I.S. Nagrah and D.P. Kothari, Tata Mc Graw Hill.
6. Power System Analysis- John Grainger and Willian Stevenson, Mc- Graw Hill.

List of e-Learning Resources:

1. https://archive.nptel.ac.in/courses/112/107/112107291/
2. https://www.udemy.com/course/basics-of-power-plant-engineering/

Mandsaur University

Diploma: Electrical Engineering

Subject Expert	**Academic Coordinator**	**HoD**	**Appointed Senior Faculty by DoAA**

Semester-IV

L-2 T-1 P-2 C-4

PEDEE0201A Electrical Engineering Drawing

Course Objectives:

- To understand fundamental principles of electrical circuit representation and symbols
- To develop proficiency in reading and creating electrical schematics and diagrams
- To gain skills in interpreting technical drawings for electrical installations
- To design power wiring diagrams for DC and AC motor starters, utilizing different starter types.
- To create detailed electrical machine drawings for DC machines, AC machines, and transformers, including assembly diagrams and component identification

Course Outcomes:

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

1. Understand the general aspects of design of electrical equipment and machines.
2. Apply different types of symbols.
3. Analyze different types of starter, field regulator, choke and control panel.
4. Evaluate different instruments circuits as ammeter, voltmeter, wattmeter, multiplier etc.
5. Create detailed electrical machine drawings, including assembly diagrams, for various types of machines and transformers

Articulation Matrix

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CO1	3	2	-	1	1	1	2	-	1	-	2	1
CO2	3	2	-	1	1	2	-	1	2	1	2	2
CO3	3	2	-	-	1	2	-	-	2	-	2	2
CO4	3	2	1	1	1	1	1	1	2	2	2	2
CO5	3	1	-	2	1	1	-	-	2	2	2	2

High-3 Medium-2 Low-1

UNIT I: Symbols & Notations **9 Hours**

Symbols of Practical Units, Types of Supplies, Single Phase, Three Phase Three Wire, Three Phase Four Wire, D.C. Supply etc. Accessories like Main Switches, Distribution Boards, Fans, Light Fixtures, Bell, Buzzer, Lighting Arrestor. All Types of Motor Starters, Instruments, Electronic Components etc.

UNIT II: Domestic Wiring **9 Hours**

All Types of Light Circuits: Staircase Wiring, Go Down Wiring, Fluorescent Tube Circuits, Intermediate Switch Circuits, Fan Circuits. Wiring of a Residential Building. Sodium Vapor Lamp, Mercury Vapor Lamp, Wiring Diagram of Electrical Bell Connection.

UNIT III: Instrument Circuits **9 Hours**

Connection of Meters in Circuits: Ammeter, Voltmeter, Wattmeter, Energy Meter, Power Factor Meter, Frequency Meter, Synchroscope etc. Extension of Range Using Shunt, Multiplier, Current Transformer, Potential Transformers etc.

UNIT IV: Power Wiring **9 Hours**

Wiring Diagrams of DC and AC Motor Starters like Three Point Shunt Motor Starter, Direct on Line (D.O.L.) Starter, Star- Delta Starter, Contactor Type and Auto Transformer Starter. Plate Earthing and Pipe Earthing as per ISS.

UNIT V: Electrical Machine Drawing **9 Hours**

Parts of D.C. Machines like, Magnetic Poles, Commutator, Armature etc. A.C. Machines Rotor, Slip Rings, etc. Various Cable Sections. Bushing of the Transformer. Assembly Diagrams of D.C. Machine, A.C. Machine, and Transformer.

Total 45 Hours

Practical List:

1. To Draw Symbols & Notations of Types of Supplies, Instruments and Accessories.
2. To Draw Symbols & Notations of Types Indicating Instrument, Recording Instrument and Control Gears.
3. To Draw Symbols & Notations of Distribution Fuse Board, Outlets, Bells and Buzzers.
4. To Draw Symbols & Notations of Types of Motor Starters and Electronic Components.
5. To Draw Different Types of Wiring: (i) Staircase Wiring (ii) Corridor Wiring.
6. To Draw Different Types of Wiring: (i) Sodium Vapour Lamp (ii) Fluorescent Lamp Wiring.
7. To Study About the Trouble Shooting of Electrical Equipment's like Fan, Iron box, Mixer-Grinder etc.
8. To Study about Earthing and their Types.
9. To Draw AC Motor Starters and DC Motor Starters.
10. To Measure the Electrical Quantities – Voltage, Current, Power and to Calculate Power Factor for RLC Circuit.
11. To Draw Connection of Instrument Circuit: Ammeter, Voltmeter, Wattmeter.
12. To Draw Connection of Instrument Circuit: Energy Meter, Power Factor Meter.
13. To Draw Connection of Instrument Circuit: Frequency Meter, Synchroscope.
14. To Draw and Calculate DC Machine Winding: Simplex Lap, Simplex Wave, Multiplex Lap, Multiplex Wave Winding.
15. To Draw and Calculate AC Machine Winding: Single Layer, Double Layer Winding.
16. To Draw Sketch of DC Machine Element: Poles, Commutator, Armature.
17. To Draw Sketch of AC Machine Element: Rotor, Slip Rings, Brush Gear, Couplings.
18. To Draw Free Hand Sketching of Machines Parts and Components: Stampings and Slots.
19. To Draw Free Hand Sketching of Machines parts and Components: Bearing and Bushing.
20. To Draw Free Hand Sketching of Machines Parts and Components: Tap Changer, Interpole and End Cover.

Total 75 Hours

Reference Books:

1. A Text Book of Electrical Drawing .by S.L. Uppal (Khanna pub.)
2. Electrical Drawing by K.L. Narang.
3. Electrical Drawing by C.R. bargan.

List of e-Learning Resources:

5. https://www.shiksha.com/online-courses/electrical-drawing-certification
6. https://www.coursera.org

Subject Expert	Academic Coordinator	HoD	Appointed Senior Faculty by DoAA

Mandsaur University

Diploma Electrical Engineering

Semester-IV

L-2 T-1 P-2 C-4

PEDEE0202A Electrical Installation

Course Objective:

- To develop expertise in designing and maintaining electrical systems for various buildings.
- To acquire proficiency in latest electrical technologies and smart system integrations.
- To master principles of estimating and costing for electrical projects accurately.
- To enhance troubleshooting skills for resolving complex electrical issues efficiently.
- To cultivates leadership and project management abilities for overseeing electrical installations.

Course Outcomes:

1. Understand the fundamental principles and concepts governing electrical installations.
2. Apply theoretical knowledge to practical scenarios in electrical installation projects.
3. Analyze electrical systems to identify potential issues and propose solutions.
4. Evaluate the effectiveness and efficiency of electrical installations based on established criteria.
5. Create innovative electrical installation designs considering safety, sustainability, and regulatory compliance.

Articulation Matrix

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	1	-	-	-	-	1	-	2
CO3	2	3	1	1	-	-	-	-	-	1	1	1
CO4	3	2	2	1	1	1	-	-	-	1	1	2
CO5	2	3	2	-	-	-	-	-	-	-	-	-

High-3 Medium-2 Low-1

Unit-I Installation of Transmission and Distribution Lines **18 Hours**

Erection of steel structures, connecting of jumpers, joints and dead ends; crossing of roads, streets, power/telecommunication lines and railway crossings, clearances; earthing of transmission lines and guarding, spacing and configuration of conductors: arrangement for suspension and strain insulators, anti-climbing devices and danger plates; sizes of conductor, earth wire, Laying of service lines.

Unit-II Laying of Underground Cables **18 Hours**

Inspection, storage, transportation and handling of cables, cable laying depths and clearances from other services such as: water, sewerage, gas, heating and other mains, excavation of trenches, direct cable laying (including laying of cable from the drum, laying cable in the trench, taking all measurements and making as installed drawings, back filling of trenches with earth or sand, laying protective layer of bricks etc), laying of cables into pipes and conduits and within buildings, cable filling compounds, epoxy resins and hardeners, cable jointing and terminations.

Unit-III Instrument Transformer **12 Hours**

Elementary idea regarding, inspection and handling of transformers; pole mounted substations, plinth mounted substations, grid substation, busbars, isolation, CT and PT, lightning arrestors, control and relay panels, HT/LT circuit breakers, LT switches, installation of transformers. Earthing system, fencing of yard, equipment foundations and trenches.

Unit-IV Equipment Testing **12 Hours**

Testing of various electrical equipment such as electrical motor, transformers cables and generator and motor control centers, medium voltage distribution panels, power control centres, motor control centers, lighting arrangement, storage, pre-installation checks, connecting and starting.

Total: 60 Hours

Reference Books:

1. Bill Atkinson, Roger Lovegrove, Gary Gundry: “Electrical Installation Designs”.
2. V.K. Jain, Amitabh Bajaj, “A Text Book of Design of Electrical Installations”.
3. Brian Scaddan “Electrical Installation Work, 8th edition” Routledge.

List of e-Learning Resources:

7. https://nptel.ac.in/
8. https://www.coursera.org/

Subject Expert	**Academic Coordinator**	**HoD**	**Appointed Senior Faculty by DoAA**