सूक्ष्म, लघु एवं मध्यम उद्यम मंत्रालय
DEVELOPMENT COMMISSIONER
MINISTRY OF MICRO, SMALL & MEDIUM ENTERPRISES
MSME TECHNOLOGY CENTRE

MODEL CURRICULUM

Qualification Name:

Assistant Electrician (Domestic cum Industrial)

Qualification Code:

Version: 2.0

NSQF Level: 3

Model Curriculum Version: 2.0

Submitted by:

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NOS /Module: Acquire the concepts of Basic Electrical

NOS /Module Code: MSME/DIE/01

Outcomes:

After completion of course learner should be able to:

- Observe safety precautions while working with electricity.
- Describe advantage of electricity.
- Explain Ohm's law.
- Explain DC series and DC parallel circuits and its utility in electrical technology.
- Measure power and consumed electrical energy in any electric load.
- Describe basic principles of electro statics and electro dynamics.
- Describe properties of the natural magnet and electro magnet.
- Define magnetic flux, leakage flux, magneto motive force, magnetizing force and flux density.
- Define hysteresis losses and eddy current losses in magnetic materials.
- Explain the working principles of cells and batteries.
- Identify the direction of mechanical force between current carrying conductor and magnetic field.
- Explain fundamental of AC, sinusoidal curve, alternating quantity, cycle, time period, frequency, instantaneous value, maximum value, average value, RMS value form factor.
- Explain behavior of AC with resistive load, inductive load and capacitor load.
- Describe star and delta connection in three phase system.
- Identify phase and neutral in three phase four wire system.
- Describe different types of electrical engineering materials and their uses.

Theory Hours: 50 **Practical Hours: -** **Theory Marks: 100** **Practical Marks: -**

Unit No.	**Unit Name**	**Unit level outcomes**	**Contents (chapters/topics)**	**TH hours**	**PR hours**
UNIT-I	Electricity	After completion of this unit learner should be able to: • Observe safety precautions while working with electricity. • Describe advantage of electricity. • Explain Ohm's law.	Safety precautions with electricity. Advantages of electrical energy in comparison with other forms of energy. Sources of energy. Comparison of sources of power. Ohm's law, voltage, current and resistance. Laws of resistance. Resistivity. Conductivity. Conductor. Insulator and semiconductor. Classification of insulating materials. Effect of temperature, moisture and electric current on conductor and insulators.	5	-
UNIT-II	DC Circuits	After completion of this unit learner should be able to:	Series circuits. Parallel circuits. Series parallel circuits. Current distribution in parallel circuits. Theory of shunt. Voltmeter. Multipliers.	5	-

		• Explain DC series and DC parallel circuits and its utility in electrical technology. • Explain Kirchhoff current law • Explain Kirchhoff Voltage law	Potential divider. Wheatstone bridge. Networks Kirchhoff's law. The Maxwell circulating current theorem. The Superposition theorem. Thevenin's theorem. Norton theorem		
UNIT-III	Units, Work, Power and Energy	After completion of this unit learner should be able to: • Measure power and consumed electrical energy in any electric load.	Types of units. Fundamental and derived units. Force, Mass, Weight, Work, Power, Energy. Relation between principle mechanical units in SI, CGS and FPS systems. Thermal units of energy system Conversion to electrical units. Thermal effect of electric current. Mechanical equivalent of heat. Practical application of heating effect of electric current.	5	-
UNIT-IV	Chemical Effect of Current	After completion of this unit learner should be able to: • Explain the working principles of cells and batteries	Primary cells. Classification of primary cells. Action of the primary cells. Daniel cell. Gravity cells. Lec Lanche cell. Dry cells. Weston standard cell. EMF of a battery or cell. Dry cell. Grouping cells. Types of electric conductors in electro chemistry electrolysis. Faraday's laws of electrolysis. Practical applications of electrolysis. Storage or secondary cells. Lead acid cells. Special charges. Alkaline batteries. Comparison between lead acid cell and nickel iron cells.	5	-
UNIT-V	Electrostatics	After completion of this unit learner should be able to: • Describe basic principles of electro statics and electro dynamics.	Coulombs law. Unit charge. Field strength. Flux. Lines of forces. Electric field due to point charge. Electro static induction. Electric flux density. Gauss theorem. Coulombs theorem.	5	-
UNIT-VI	Magnetism and Electromagnetism	After completion of this unit learner should be able to: • Describe properties of the natural magnet and electro magnet. • Define magnetic flux, leakage flux, magneto motive force, magnetizing force and flux	Magnets. Artificial magnets. Magnetic materials. Magnetic induction. Magnetic force. Magnetic field. Coulombs laws. Unit pole. Relative permeability. Magnetic field strength. Magnetic potential. Magnetic lines of forces magnetic flux. Magnetic flux density. Relationship H, B and U. Magnetic moment. Intensity of magnetization. Susceptibility. Deflecting couple on a magnet suspended in uniform magnetic field. Natural	5	-

		density. • Define hysteresis losses and eddy current losses in magnetic materials. • Identify the direction of mechanical force between current carrying conductor and magnetic field.	points. Magnetic field due to current carrying conductor. Ampere's law. Unit current. Biot Savart's law. Force on a current carrying conductor lying in the magnetic field. Production of EMF. Faradays law of electromagnetic induction. Lenz's law. Induced EMF- dynamically induced, statically induced, self-induction, mutually induced EMF. Determination of B-H curve by ballistic galvanometer. Determination of hysterics loop Electromagnets. Effect of self-induction in DC circuits. Rise of current/decay of current. Eddy current.		
UNIT-VII	Fundamental of Alternating Current	After completion of this unit learner should be able to: • Explain fundamental of AC, sinusoidal curve, alternating quantity, cycle, time period, frequency, instantaneous value, maximum value, average value, RMS value form factor.	Use of alternating currents. Production of alternating EMF. Alternating quantity. Alternation and cycle. Time period and frequency. Equation for waveform of sinusoidal quantities (current or voltage). Electrical degree and relation between frequencies, speed of generator and number of poles on generator. Alternating current. Instantaneous, maximum value and average or mean value, RMS, or effective value of alternating current or voltage. Determination of maximum value in frequency from EMF or current equations. Form factor and peak factor. Vector diagram using RMS values. Phase and phase difference. Additions of two alternating quantities convection for vector diagram.	5	-
UNIT-VIII	AC Series and Parallel Circuits	After completion of this unit learner should be able to: • Explain behavior of AC with resistive load, inductive load and capacitor load.	Introduction. Pure resistive circuits. Inductive circuits. Capacitive circuits. Resistance and inductive reactance in series. Apparent power. True power. Reactive power and power factor. Solution of parallel circuit. Resonance in Series circuits. Resonance in parallel circuits.	5	-

UNIT-IX	Poly Phase System	After completion of this unit learner should be able to: • Describe star and delta connection in three phase system. • Identify phase and neutral in three phase four wire system.	Advantage of poly phase system over single phase system. Generation of EMF. Single phase EMF. Two phase EMF. Three phase EMF. Phase sequence. Inter connection of three phase, star and delta connection. Comparison between star delta connections. Measurement of power in three phase circuits. Three phase four wire systems. Two Wattmeter method	5	-
UNIT-X	Electrical Engineering Materials	After completion of this unit learner should be able to: • Describe different types of electrical engineering materials and their uses.	Conducting materials. Magnetic materials. Insulating materials. Resistive materials. Semi-conducting materials. Electrical properties.	5	-

COURSES / MODULE TEMPLATE

NOS /Module: Measure Electrical Parameters (Voltage, Current, Power etc.)

NOS /Module Code: MSME/DIE/02

Outcomes:

After completion of course learner should be able to:

- Explain safety precautions in handling tools and equipment.
- Identify the various tools used by an electrician.
- Select the proper tool.
- Use and maintain the tools used by an electrician.
- Give the specification of tools for different applications.
- Measure the length and diameter with Vernier Calipers and Micrometer.
- Select and use AC/DC voltmeter, Ammeter as per requirements.
- State the working principle of CT & PT and describe their use.
- Measure power using wattmeter.
- Describe the use of DC regulated power supply, auto transformer/variacs.
- Use electronic measuring instruments such as multimeter and CRO etc. for electrical measurements.

THEORY HOURS: 30 PRACTICAL HOURS: 50 THEORY MARKS: - PRACTICAL MARKS: 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	PR hours
UNIT-I	Tools	After completion of this unit learner should be able to: • Explain safety precautions in handling tools and equipment. • Identify the various tools used by an electrician. • Select the proper tool. • Use and maintain the tools used by an electrician. • Give the specification of tools for different applications.	Safety and precautions in handling the tools. Screw driver. Pliers. Electrician knife. Hammers. Hand saw. Cold chisel. Try square. Wood chisel. Poker. Hand drill machine. Rawl plug tool. Hacksaw. Files. Ratchet bit brace. Plumb bob. Pipe vice. Pin vice. Bench vice. Hand vice. Centre punch. Pipe wrench. Blow lamp. Pipe cutter. Reamer. Respent file. Spanner sets- double ended spanner, ring spanner, box spanner, slide wrench spanner. Machinery drill bit. Crimping tools. Measuring tape. Pulley puller. Bearing puller. Ship straights. Phase tester or neon tester. Mallet. Wire stripper and cutter. Soldering iron. Soldering station. Desoldering pump. Tweezer. Brushes. Magnifying glass.	10	16
UNIT-II	Measuring Tools	After completion of this unit learner should be able to:	Vernier Calipers. Screw Gauge (Micrometer). Measuring	10	17

		• Measure the length and diameter with Vernier Calipers and Micrometer.	scales. Standard wire gauge (SWG) instruments.		
UNIT-III	Equipments	After completion of this unit learner should be able to: • Select and use AC/DC voltmeter, Ammeter as per requirements. • State the working principle of CT & PT and describe their use. • Measure power using wattmeter. • Describe the use of DC regulated power supply, auto transformer/variacs. • Use electronic measuring instruments such as multimeter and CRO etc. for electrical measurements.	Galvanometers. Ammeters and Volt meters. Types of instruments. Error common to all types of instruments. Moving coil instruments. Instruments range. Ammeter shunts. Voltmeter multiplier. Watt meter. Watt meter errors. Measurement of power in single phase AC circuit, 3 voltmeter method, 3 ammeter method. Measurements of power in three phase circuits. Measurement of frequency with a frequency meter. Power factor meter. Current transformers. Potential transformers. Measurement of high resistance. Megger. Multimeter and its uses. Measurement of voltage, current & resistance with multimeters. Safety precautions for Multimeter , Auto transformers and its use. DC regulated power supply and its use. CRO (cathode rays oscilloscope) and its use. Digital Multimeter and its use. Digital volt meter and ammeters and their use. LCR meter and its use.	10	17

COURSES / MODULE TEMPLATE

NOS /Module: Prepare for Domestic and Industrial Electrical Wiring

NOS /Module Code: MSME/DIE/03

Outcomes:

After completion of course learner should be able to

- Identify different types of wire joints and prepare different wire joints.
- Describe the specifications of different components and materials used in house wiring installation.
- Explain the different type of wiring system.
- Draw the different types of electrical wiring circuits.
- Choose proper type of wiring system as per customer's requirements
- Perform power wiring for industrial systems.
- Design and wire up simple electrical circuit in the house.
- Estimate the wiring installation in a house.
- Calculate proper size of wire as per load connected in the wiring installation.
- Explain the different types of fuses and calculate the size of fuse wire.
- Explain the electrical earthing system and its need for wiring installation.
- Draw a wiring diagram for a house.
- Test the wiring installation with megger.
- Identify the fault in wiring installation and repair the fault.
- Identify the different types of power wiring accessories.
- Describe the different types of substations.
- Explain the provisions of Indian Electricity Rules 1956.
- Perform electrical shock treatment.
- Understand the Calculation of wire selection.
- Understand types component used according to load.

THEORY HOURS: 30 PRACTICAL HOURS: 140 THEORY MARKS: - PRACTICAL MARKS: 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	PR hours
UNIT-I	Wire Joints	After completion of this unit learner should be able to: • Identify different types of wire joints and prepare different wire joints. • Calculate proper size of wire as per load connected in the wiring installation.	Wires. Wire splicing and termination. Size of wire. Standard wire. Types of wires. Rubber covered. Taped. Braided compound wires. Lead alloy sheathed wires. Weather proof wires. Flexible wires. Western union spoliator twist spice. Married joints single branch splice or tap joint double branch splice. Tap joint for standard wires. Flexible card splicing. Pigtail joint. Pigtail joint of a solid conductor and flexible wire. Terminal of wire at terminal screws.	03	14

UNIT-II	Type and Installation of Wiring Systems	After completion of this unit learner should be able to: • Design and wire up simple electrical circuit in the house. • Draw a wiring diagram for a house. • Identify the fault in wiring installation and repair the fault. • Identify the different types of power wiring accessories.	Introduction. Method of Installation and wiring. Cleat wiring. Wooden/PVC casing and capping. Concealed wiring Installation of conduit wiring. Thin wall conduits. Ring conduits. Flexible conduits. Conduit accessories. Coupling. Elbows. Bushing lock nuts. Conduits nipples. Box connectors. Bushings for flexible conduits. Conduit reducers. Conduit Box. Conduit saddles or conduit clamps. Conduit filling fishing wires through rigid conduit. Conduit cutting and threading. Comparison of various wiring systems.	03	14
UNIT-III	Lighting Accessories	After completion of this unit learner should be able to: • Describe the specifications of different components and materials used in house wiring installation.	Introduction. Switches. Surface switches. Flush switches. Pull switches or ceiling switches. Grid switches. Architrave switches. Rotary snap switches. Push button switches. Iron clad water tight switches. Intestinal iron clad switches. Quick break knife switches. Isolator. MCB. ELCB Contactor. Relays. Timers. Lamp holder. Switches Bayonet cap lamp holder. Small Bayonet cap holder. Goliath Edition screw lamp holder. Medium edition. Sorrow lamp holder. Porcelain lamp holder. Swivel lamp holder. Fluorescent lamp. Lamp holder and starter holder. Ceiling roses. Mounting blocks. Socket outlets.	03	14

			Plugs terminal blocks. Appliances connection. Main switches. Splatter unit. Distribution fuse. Board neutral links.		
UNIT-IV	Fuses	After completion of this unit learner should be able to: • Explain the different types of fuses and calculate the size of fuse wire.	Introduction. Melting point of various metals. Silver as fuse element. Copper as fuse wire. Lead tin alloy as fuse wire. Fuse holder. Generally used terms. Kit kat type fuse. Cartridge types fuse. H.R.C. type fuse.	03	14
UNIT-V	Wiring Systems and Circuits	After completion of this unit learner should be able to: • Explain the different type of wiring system. • Draw the different types of electrical wiring circuits. • Choose proper type of wiring system as per • customer's • requirements. • Perform power wiring for industrial systems.	Wiring systems. Looping in system. Wiring of a building. Free system. Lamp circuits. Simple circuits. Series parallel circuits. Master switches circuits. Pilot circuits. Circuits using special type of switches. Use of marvel switches. Lamp control circuit from more than two points or alternative method of corridor lighting. Use of parallel or series switches. Use of reversing switches. Fluorescent tube lighting. Tube circuit with a terminal switch. Tube circuit with glow starting switches. The instant starting circuit of fluorescent tube. Flasher for moving light. Wiring of electric motors, control panel, etc. Types, specifications, advantages of different types Of circuit breakers and their maintenance. Layout of control panel.	03	14
UNIT-VI	Electrical Earthing and Shock	After completion of this unit learner should be able to: • Explain the electrical earthing system and its need for wiring. installation. • Test the wiring installation with megger.	Neutral wire. Why earthing is required? Fire hazard from electricity. Why fuse is not used in the neutral? Connection with earth. Value of earth resistance and factor on which it is dependent. Method of earthing. Definition. Points to remember while earthing. Earth leakage circuit breaker. Electric shock. Cure of shock.	03	14

			Artificial respiration. Precaution against shock.		
UNIT-VII	Estimating and Costing	After completion of this unit learner should be able to: • Estimate the wiring installation in a house.	Estimating and conductor size calculations for internal wiring and underground cables in domestic purpose. Price catalogue. Schedule of labour rates. Schedule of rates and estimating data. Determination of conductor size. Current carrying capacity. Voltage drop. Minimum permissible size. Conductor size calculation for internal domestic wiring. Internal wiring estimating.	03	14
UNIT-VIII	Substations	After completion of this unit learner should be able to: • Describe the different types of substations. • Explain the provisions of Indian Electricity Rules 1956.	Introduction to different types of substations. Transformers. Advantage of outdoor substations as compared to indoor substations. Equipment used in substations. Circuit breaker. Oil circuit breaker. Air Circuit breaker Vacuum Circuit breaker General specifications of diesel engine. Generator set. Transmission and distribution system. Extract from Indian Electricity rules 1956.	03	14
UNIT-IX	Control panel wiring of industrial AC Motors	After completion of this unit learner should be able to: • Learn about the starters of motors • Learn about the Wiring of single phase and three phase motor	Build Contactor control circuits - Push button operation, Logic building using NC /NO (Normally open/Normally closed) controls select, operate and maintain the tools and equipment required for installing and operating an AC motor troubleshoot and take general care maintenance of AC motor select, operate and maintain the tools and equipment required for installing and operating an AC motor	03	14
UNIT- X	Wiring of the distribution board	After completion of unit Student should be able to • Understand the Calculation of wire selection • Understand types component used according to load.	A distribution board (also known as panel board, breaker panel, electric panel, fuse box or DB box) is a component of an electricity supply system that divides an electrical power feed into subsidiary circuits while providing a protective fuse or circuit breaker for each circuit in a common enclosure	03	14

NOS /Module: Perform Transformer Testing and Maintenance

NOS /Module Code: MSME/DIE/04

Outcomes:

After completion of course Learner should be able to

- Draw the symbols, abbreviations used in transformer designing.
- Define magnetic flux, leakage flux, magnetizing force and flux density.
- Explain working principle of a simple transformer.
- Define the hysteresis losses and eddy current losses in magnetic material.
- Describe the properties of core material and their types.
- Select the proper core material size & shape.
- Explain basic considerations of winding.
- Explain characteristics of super enamel copper wire.
- Select the proper size of copper conductor for a transformer.
- Select the proper insulation for winding a coil.
- Wind a coil for required transformer and assemble core along with coil.
- Explain different tests required for a transformer.
- Explain temperature rise and its effect on the performance of transformer.
- State the design equations of the transformer.
- Design the main transformer up to 5KVA.
- Design the transformer for voltage stabilizer.
- Operate, repair and maintain the winding machine.

THEORY HOURS: 30 PRACTICAL HOURS: 50 THEORY MARKS: - PRACTICAL MARKS: 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	PR hours
UNIT-I	Symbols and Abbreviations	After completion of this unit learner should be able to: • Draw the symbols, • Abbreviations used in transformer designing.	Symbols, abbreviations and other references used in transformer technology.	3	5
UNIT-II	Elementary Concepts	After completion of this unit learner should be able to: • Define magnetic flux, leakage flux, magnetizing force and flux density.	Elementary electromagnetic. Development of transformer. Conventional transformer. Imagery of electromagnetic. The magnetic circuit. Electromagnetic Ohm's law.	3	5
UNIT-III	Transformer Ratings and Equations	After completion of this unit learner should be able to: • Explain working principle of a simple	Properties of transformers. Kinds of transformation. Tapped winding. Kinds of transformer.	3	5

		transformer.	Transformer ratings. Two basic design equations.		
UNIT-IV	Losses in Transformer	After completion of this unit learner should be able to: • Define the hysteresis losses and eddy current losses in magnetic material.	Stray capacitance and leakage inductance. Iron losses. Apparent loss. The equivalent circuit. Combining current and voltage and turn ratio. Regulation transformer resistance. Losses and guesstimates geometry of losses. More on regulation, losses and temperature rises.	3	5
UNIT-V	The Core	After completion of this unit learner should be able to: • Describe the properties of core material and their types. • Select the proper core material size & shape.	Properties of core materials. Kind of alloys. The soft ferrites. Relative performance of cores. Configuration and proportions. The Window Area (WA) product. Arithmetic of core dimensions. Manufacturer's data sheets. Core selection.	3	5
UNIT-VI	The Winding	After completion of this unit learner should be able to: • Explain basic considerations of winding. • Explain characteristics of super enamel copper wire. • Select the proper size of copper conductor for a transformer. • Select the proper insulation for winding a coil. • Wind a coil for required transformer • and assemble core along with coil.	Basic format. Copper wire table. Insulation. Build. More on Window Area (WA) product. Temperature. Minimizing stray capacitance and leakage inductance. Other kind of windings. Windings on tape wound core.	3	5
UNIT-VII	Designing	After completion of this unit learner should be able to: • State the design equations of the transformer. • Design the main transformer up to 5KVA. • Design the transformer	Summarized data and generate design consideration summary of formulas. The specification, mounting position volt ampere ratings. Specification for published project. The design sheets. General observations. Flux density current density. High current and high voltage. Power	3	5

		for voltage stabilizer.	transformer designing. Five variants of a basic specification improving of efficiency and regulation. Low frequencies compared with high frequencies. Adjustment of magnetizing current.		
UNIT-VIII	Salvage Construction and Sources	After completion of this unit learner should be able to: • Operate, repair and maintain the winding machine.	Junk. Salvaging core. Making a new bobbin. The coil winder preparation of a coil- winding machine. Type of coil winding machine. Winding of a coil. Soldering and preparation of transformer leads. Sources of transformer materials. Assembly of core. Winding of toroid by hands.	3	5
UNIT-IX	Test & Measurements	After completion of this unit learner should be able to: • Explain different tests required for a transformer. • Explain temperature rise and its effect on the performance of transformer.	Word of caution output voltage and regulation. Resistance reading and temperature rise. Relative polarity polarities measuring inductance. Adjusting the gap. Leakage inductance. Ratings. Number of turns. Testing of insulation. Checking salvaged wire. Detecting shorted turns. Measuring meter resistance.	6	10

COURSES / MODULE TEMPLATE

NOS /Module: Power Equipment Testing and Maintenance

NOS /Module Code: MSME/DIE/05

Outcomes:

After completion of course Learner should be able to

- Design, manufacture of multi tapping auto transformer.
- Explain construction and working principle of auto cut voltage stabilizer.
- Assembly of auto cut voltage stabilizer circuit using DPDT switch.
- Fault finding and repairing of auto cut voltage stabilizer.
- Auto transformer designing for automatic voltage stabilizer.
- Working principle of automatic voltage stabilizer using DC supply.
- Setting or alignment of automatic voltage stabilizer with variacs.
- Fault finding and repairing of automatic voltage stabilizer.
- Explain different types of power rectification circuit with silicon diodes.
- Explain different types of power rectification circuit with different types of filter circuits.
- Explain definitions of cell and battery, primary battery, secondary battery.
- Reconditioning of lead acid battery.
- Design and assemble different types of battery charger.
- Fault finding and repairing of different types of battery charger.
- Explain circuit diagram of an UPS.
- Repair and maintenance of UPS.
- Explain of basic working principle of inverter.
- Explain different type of 500W MOSFET based inverter circuit with charger.
- Assemble different types of inverter circuit with charger.
- Install different types of inverter circuit with charger.
- Fault finding of different types of inverter circuit with charger.

THEORY HOURS: -20 PRACTICAL HOURS: 60 THEORY MARKS: - PRACTICAL MARKS: 100

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	PR hours
UNIT-I	Design, Manufacture and Assembly of Transformer for Voltage Stabilizer	After completion of this unit learner should be able to: • Design, manufacture of multi tapping auto transformer. • Auto transformer designing for automatic voltage stabilizer.	Winding machine, construction, operation and maintenance. Winding systems on manual coil winding machine. Winding system on motorized coil winding machine. Assembly of coils with core and fitting of clamps. Soldering of tags of transformer. Testing of relative polarity (Phase test). Testing of transformer turn ratio. Testing of inductance of coils. Testing of transformer regulation. Testing of temperature rise in transformer. Testing of insulation resistance for	2	10

			transformers. Testing of short/open circuit in transformer coils. Testing of high voltage break down. Design of multi tapping auto transformer. Design examples multi tapping auto transformer. Manufacturing multi trapping auto transformer. Testing of multi tapping auto transformer. Auto transformer designing of automatic voltage stabilizer. Winding of transformer of automatic voltage stabilizer. Testing of transformer of automatic voltage stabilizer. Winding data of transformer for automatic voltage stabilizer from 0.25 KVA to 8 KVA on the bases of 140V, 110V, 90V.		
UNIT-II	Manufacturing Technology of Voltage Stabilizer	After completion of this unit learner should be able to: • Explain construction and working principle of auto cut voltage stabilizer. • Assembly of auto cut voltage stabilizer circuit using DPDT switch. • Fault finding and repairing of auto cut voltage stabilizer. Working principle of automatic voltage stabilizer using DC supply. • Setting or alignment of automatic voltage stabilizer with variacs. • Fault finding and repairing of automatic voltage stabilizer.	Relays, construction, working principle and different type of relays. Auto cut voltage stabilizer and working principle of auto cut voltage stabilizer. Control circuit using auto cut voltage stabilizer. Control circuit using single transistor, and working principle. Simple auto cut voltage stabilizer circuit. Assembly of auto cut voltage stabilizer circuit using DPDT switch. Assembly auto cut voltage stabilizer using single transistor switching circuit. Setting of pre set in single transistor switching circuit. Working principle of automatic voltage stabilizer. Comparators using IC-741 (or Operation Amplifiers Comparators). What is hysteresis and chattering in relay? Relay driver, without hysteresis and chattering in relay. A special electronic protection circuit with time delay. Simple automatic voltage stabilizer using single relay. Simple automatic voltage stabilizer using two relay/three relay. Simple automatic voltage stabilizer with over voltage/under voltage cut off circuit using four relays. Protective devices- fuse.	3	10

			Use of Miniature Circuit Breaker (MCB). Setting or alignment of automatic voltage stabilizer with variacs. Wiring diagram of different relays. Main fault in automatic voltage stabilizer. Design of bobbin & construction of a bobbin.		
UNIT-III	Power Rectification	After completion of this unit learner should be able to: • Explain different types of power rectification circuit with silicon diodes. • Explain different types of power rectification circuit with different types of filter circuits.	Power rectification with silicon diodes. Single phase rectifier circuit. Rectifier circuit with resistive load. Full wave bridge circuit. Performance with resistive load. Voltage relationship. Current relationship. Crest working voltage. Transformer ratings. Percentage reptile. Single phase with capacitor input filer. Half wave circuit. Performance of half wave circuit. Full wave circuit. Comparison of single phase & full wave. Rectifier circuit (Bridge and Center Tapped). Application of single phase half wave and full wave circuits.	3	7
UNIT-IV	Lead Acid Battery/Maintenance Free Battery	After completion of this unit learner should be able to: • Explain definitions of cell and battery, primary battery, secondary battery. • Reconditioning of lead acid battery. • Repair and maintenance of battery.	Primary battery, secondary. Series and parallel connection. Components used in a battery. Zinc-carbon battery, rechargeable cell, nickel-cadmium cell. Lead-acid cell, components used in a lead-acid cell and battery. Battery types, automobile batteries. Tubular/industrial lead acid batteries. Nickel cadmium batteries. Sealed maintenance free (SMF) batteries. Battery rating. Battery operation. Battery manufacturing. Checking of battery acid level. Battery capacity and condition. Checking battery water level. Reconditioning of lead acid battery.	3	7
UNIT-V	Battery Charger	After completion of this unit learner should be able to:	Charger design, Constant voltage charger, Constant current charger, Constant voltage &	3	7

		• Design and assemble different types of battery charger. • Fault finding and repairing of different types of battery charger.	constant current charger. A simple battery charger 6V/12V/24V, -5A. Charger operation. Design and assemble different types of battery charger.		
UNIT-VI	UPS	After completion of this unit learner should be able to: • Explain circuit diagram of an UPS. • Repair and maintenance of UPS.	Working principle of UPS. Connection diagram of UPS. Testing of UPS. Fault finding and repairing of UPS.	3	7
UNIT-VII	Inverter	After completion of this unit learner should be able to: • Explain of basic working principle of inverter. • Explain different type of 500W MOSFET based inverter circuit with charger. • Assemble different types of inverter circuit with charger. • Fault finding of different types of inverter circuit with charger.	Basic working principle of inverter. Different types of 500W MOSFET based inverter circuit with charger. Assemble different types of inverter circuit with charger. Install different types of inverter circuit with charger. Fault finding of different types of inverter circuit with charger.	3	12

COURSES / MODULE TEMPLATE

NOS /Module: Repair and Maintenance of Electrical Machines

NOS /Module Code: MSME/DIE/06

Outcomes:

After completion of course Learner should be able to

- Explain the construction and operating principle of DC generator.
- Explain the construction and operating principle of DC motor.
- Carry out, servicing and repair of DC generators.
- Carry out, servicing and repair of DC motors.
- Explain construction, operating principle of transformer.
- Explain construction and operating principle of alternator.
- Repair faults in alternator and install the alternator.
- Explain construction and operating principle of three phase induction motor.
- Test and identify the terminal of a DC generator.
- Test and identify the terminal of a DC motor.
- Test and identify the terminals of three phase induction motor.
- Test a three-phase induction motor for insulation resistance and earth effectiveness.
- Connect with suitable starter, to start and run the DC motor.
- Connect with suitable starter to start and run three phase induction motor.
- Explain the construction, operating principle of different single phase or fractional horsepower (HP) motors.
- Identify the parts for repairing and servicing the fractional HP motor.
- Troubleshoot different type of starter for DC motor.

THEORY HOURS: 30 PRACTICAL HOURS: 20 THEORY MARKS: 100 PRACTICAL MARKS: -

Unit No.	Unit Name	Unit level outcomes	Contents (chapters/topics)	TH hours	PR hours
UNIT-I	DC Generator	After completion of this unit learner should be able to: • Explain the construction and operating principle of DC generator. • Carry out, servicing and repair of DC generators. • Test and identify the terminal of a DC generator.	DC generator. Construction and working principle. Type of DC generator. Separately excited generator and self-excited generator. Armature Reaction. Commutation methods to improve commutation.	05	03
UNIT-II	DC Motor	After completion of this unit learner should be able to: • Explain the construction and operating principle of DC motor. • Carry out, servicing and repair of DC motors. • Test and identify the terminal of a DC motor. • Connect with suitable	Fleming's left-hand rule. Construction and working principle of DC motor. Types of DC motors. Speed regulation. Torque. Back EMF. Starting of DC motors. 3-point starter.	05	04

		starter, to start and run the DC motor. • Troubleshoot different type of starter for DC motor.	4-point starter. Series motor starter. Speed control of DC motors. Different losses in DC motors. Servicing, fault repairing and installation of DC generator or DC motor.		
UNIT-III	Transformer	After completion of this unit learner should be able to: • Explain construction, operating principle of transformer.	Construction and operating principle of transformer. EMF equation. Voltage transformation ratio; current ratio. Types of transformers. Method of cooling. Auto transformers. Three phase transformers. Three phase transformer connection. Determination of efficiency and regulation of transformer from open circuit and short circuit tests.	05	04
UNIT-IV	Alternator	After completion of this unit learner should be able to: • Explain construction and operating principle of alternator.	Alternator. Construction and working principle. Production of sinusoidal alternating EMF. Moving field and moving armature type alternator and its advantages. Salient Pole and cylindrical type alternator. Relation between speed and frequency of alternator. Servicing, operation and maintenance of alternator.	05	03
UNIT-V	Induction Motor	After completion of this unit learner should be able to: • Explain construction and operating principle of three phase induction motor. Test and identify the terminals of	Introduction. Polyphase induction motors. Construction and Operating principle of induction motors. Types of 3 phase induction motors squirrel cage and wound	05	03

		three phase induction motor. • Test a three-phase induction motor for insulation resistance and earth effectiveness. • Connect with suitable starter to start and run three phase induction motor. • Troubleshoot different type of starter for AC motor.	rotor type motor. Torque formula. Effect of change of supply voltage on starting torque. Full load torque and maximum torque. Testing of induction motor. Real speed and synchronous speed. Identification of terminal sequence. Starting of induction motor different type of starter. DOL starter. Star delta starter. Auto transformer starter. Speed control of induction motor. Drawback of speed controlled induction motors.		
UNIT-VI	Fractional Horse Power Motors	After completion of this unit learner should be able to: • Explain the construction, operating principle of different single phase or fractional horsepower (HP) motors. • Identify the parts for repairing and servicing the fractional HP motor.	Split phase induction motor. Capacitor start motors-Permanent capacitor motor, Repulsion motor, Shaded pole motors, Universal motors. Speed control. Motor applications. Split phase induction motor. Trouble chart. Repulsion start induction brush lighting motor trouble chart. Capacitor start induction motor trouble chart.	05	03

COURSES / MODULE TEMPLATE

NOS /Module: Employability Skill

NOS /Module Code: MSME/ES/01

THEORY HOURS: 30 PRACTICAL HOURS: - THEORY MARKS: 100 PRACTICAL MARKS: -

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