

CRAFTSMEN TRAINING SCHEME (CTS)

ANNUAL INSTRUCTIONAL PLAN
ELECTRICIAN (2ND YEAR – 42 WEEKS)

Curriculum as per DGT / CSTARI Guidelines for Electrician CTS Scheme

Trade Name	ELECTRICIAN (Engineering Trade)
NSQF Level & Duration	NSQF Level-4 Two Years (Second Year - 42 Weeks)
Academic Session	20__ - 20__
Institute Name & Address	
Instructor Name & Designation	
Group Instructor (GI) Name	
Principal / Supt. Name	

WEEKLY INSTRUCTIONAL PLAN (WEEK 01 TO WEEK 42)

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
WEEK 01	DC Generator Principles & Components: 1. Identify terminals, parts and connections of different types of DC machines. 2. Measure field and armature resistance of DC machines.	DC Rotating Machines: 1. General concept of rotating electrical machines. 2. Principle of DC generator. 3. Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring, Brushes, Laminated core. 4. E.M.F. equation of DC generator.
WEEK 02	DC Shunt & Compound Generators: 3. Determine build up voltage of DC shunt generator with varying field excitation and performance analysis on load. 4. Test for continuity and insulation resistance of DC machine.	5. Separately excited and self-excited generators. 6. Series, shunt and compound generators. 7. Armature reaction, Commutation, inter poles and connection of inter poles.
WEEK 03	DC Generator Characteristics & Parallel Operation: 5. Perform no load and load test and determine characteristics of series and shunt generators. 6. Perform no load and load test and determine characteristics of compound generators (cumulative and differential).	8. Parallel Operation of DC Generators. 9. Load characteristics of DC generators. 10. Application, losses & efficiency of DC Generators, Routine & maintenance.
WEEK 04	DC Motors & Reversing: 7. Start, run and reverse direction of rotation of DC series, shunt and compound motors. 8. Conduct performance analysis of DC series, shunt and compound motors.	DC Motor Principles: 11. Principle and types of DC motor. 12. Relation between applied voltage, back e.m.f., armature voltage drop, speed and flux of DC motor. 13. Relation between torque, flux and armature current, Changing direction of rotation.
WEEK 05	DC Starters & Maintenance: 9. Dismantle and identify parts of three-point and four-point DC motor starters. 10. Assemble, service and repair three-point and four-point DC motor starters. 11. Practice maintenance of carbon brushes, brush holders, Commutator and sliprings.	14. DC motor Starters (3-point and 4-point starters, necessity and functions). 15. Characteristics, Losses & Efficiency of DC motors. 16. Routine and breakdown maintenance of DC machines.
WEEK 06	Speed Control & DC Overhauling: 12. Perform speed control of DC motors (field and armature control methods). 13. Practice dismantling and assembling in DC shunt motor and DC compound generator. 14. Carry out overhauling of DC machines.	17. Methods of speed control of DC motors (armature rheostatic, field diverter, Ward-Leonard). 18. Overhauling procedures, bearing maintenance, brush seating, commutator skimming and undercut.
WEEK 07	DC Armature Winding: 15. Perform DC machine winding by developing connection diagram, test on growler and assemble.	19. Lap and wave winding, dummy coils, equalizer rings and related winding terms. 20. Growler testing (short circuit, open circuit, and ground faults).
WEEK 08	3-Phase Induction Motors: 16. Identify parts and terminals of three phase AC motors. 17. Connect, start and run three phase induction motors by using DOL, star-delta and auto-transformer starters.	3-Phase Induction Motor Principles: 21. Working principle of three phase induction motor. 22. Squirrel Cage Induction motor and Slip-ring induction motor: construction, characteristics, Slip and Torque.
WEEK 09	AC Starters & Slip-Ring Motors: 18. Make internal connection of automatic star-delta starter with three contactors. 19. Connect, start, run and reverse direction of rotation of slip-ring motor through rotor resistance starter and determine performance characteristic.	23. Starters for three-phase induction motors (DOL, Star-Delta, Auto-transformer, Rotor resistance). 24. Contactor control circuits, timers, overload relays and interlocks.
WEEK 10	Induction Motor Testing: 20. Determine efficiency of squirrel cage induction motor by brake test. 21. Determine efficiency of three phase squirrel cage induction motor by no-load test and blocked-rotor test. 22. Test for continuity and insulation resistance of three phase induction motors.	25. Single phasing prevention and protections. 26. No-load test, blocked rotor test, losses & efficiency calculations. 27. Insulation resistance and continuity testing using Megger.
WEEK 11	Speed Control & Braking of AC Motors: 23. Measure slip and power factor to draw speed-torque (slip/torque) characteristics. 24. Perform speed control of three phase induction motors by various methods (rheostatic, autotransformer etc.).	28. Speed-torque characteristics, slip calculations and torque relations. 29. Methods of speed control of 3-phase induction motors. 30. Electric braking systems (regenerative, plugging, dynamic).
WEEK 12	3-Phase AC Motor Winding: 25. Perform winding of three phase AC motor by developing connection diagram, test and assemble. 26. Maintain, service and troubleshoot the AC motor starter.	31. Concentric / distributed, single / double layer winding and related terms. 32. Maintenance, servicing, and troubleshooting of AC motor starters and contactors.

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WEEK 13	Single Phase AC Motors: 27. Identify parts and terminals of different types of single-phase AC motors. 28. Install, connect and determine performance of single-phase AC motors. 29. Start, run and reverse direction of rotation of single-phase AC motors.	Single Phase Motor Principles: 33. Working principle, split phase, capacitor start/run, shaded pole motors. 34. Domestic and industrial applications of single-phase AC motors. 35. Characteristics, losses and efficiency.
WEEK 14	Universal Motor & Speed Control: 30. Practice on speed control of single-phase AC motors. 31. Compare starting and running winding currents of a capacitor run motor at various loads and measure speed. 32. Connect, start, run and reverse direction of rotation of universal motor.	36. Speed control methods for single-phase induction motors. 37. Construction, working principle, and applications of Universal motor. 38. Centrifugal switch operation and troubleshooting.
WEEK 15	Single Phase Motor Winding & Servicing: 33. Carry out maintenance, service and repair of single-phase AC motors and universal motor. 34. Practice single/double layer and concentric winding for AC motors, testing and assembling.	39. Rewinding techniques of single phase AC motors and ceiling fan stator. 40. Troubleshooting single-phase induction motors and universal motors.
WEEK 16	Alternator Construction & Testing: 35. Install an alternator, identify parts and terminals of alternator. 36. Test for continuity and insulation resistance of alternator. 37. Connect, start and run an alternator and build up voltage.	Alternator Principles: 41. Principle of alternator, e.m.f. equation, relation between poles, speed and frequency. 42. Types, construction (salient pole vs cylindrical rotor). 43. Excitation systems and terminal voltage build-up.
WEEK 17	Alternator Regulation & Synchronization: 38. Determine load performance and voltage regulation of three phase alternator. 39. Parallel operation and synchronization of three phase alternators.	44. Voltage regulation, efficiency, characteristics, phase sequence. 45. Parallel operation conditions, synchronizing lamps, and synchroscope methods. 46. Effect of changing field excitation and power factor correction.
WEEK 18	Synchronous Motors & MG Set: 40. Install a synchronous motor, identify its parts and terminals. 41. Connect, start and plot V-curves for synchronous motor under different excitation and load conditions.	Synchronous Machine Theory: 47. Working principle of synchronous motor and starting methods. 48. Effect of change of excitation and load, V-curves and inverted V-curves. 49. Synchronous condenser and power factor improvement.
WEEK 19	MG Set & Converter Operation: 42. Identify parts and terminals of MG set. 43. Start and load MG set with 3 phase induction motor coupled to DC shunt generator.	50. Rotary Converter, Motor-Generator (MG) Set description and applications. 51. Maintenance, alignment, and load characteristics of MG sets.
WEEK 20	Passive & Active Electronics: 44. Determine resistance value by colour code and identify types. 45. Test active and passive electronic components and their applications. 46. Determine V-I characteristics of semiconductor diode.	Semiconductor Theory: 52. Resistors colour code, types and power ratings. 53. Active and passive components. 54. Atomic structure and semiconductor theory (intrinsic/extrinsic). 55. P-N junction, biasing, and V-I characteristics of diodes.
WEEK 21	Rectifiers & Filters: 47. Construct half wave, full wave and bridge rectifiers using semiconductor diodes. 48. Make a printed circuit board (PCB) for power supply. 49. Troubleshoot defects in simple power supplies.	56. Rectifier circuits: Half wave, Full wave center-tapped, and Bridge rectifiers. 57. Filter circuits (Capacitor, Inductor, LC, and Pi filters), ripple factor. 58. PCB preparation steps and soldering procedures.
WEEK 22	Transistors & Regulators: 50. Check transistors for functioning by identifying types and terminals. 51. Bias transistor and determine its characteristics. 52. Use transistor as electronic switch and series voltage regulator.	59. Principle of operation, types (NPN/PNP), characteristics and configurations (CB, CE, CC). 60. Transistor applications as switch, amplifier, and voltage regulator. 61. IC voltage regulators (78xx, 79xx, LM317 series).
WEEK 23	Power Electronics (UJT, FET & Thyristors): 53. Construct simple circuits containing UJT for triggering and FET as an amplifier. 54. Construct power control circuit by SCR, Diac, Triac and IGBT.	62. Power electronics devices: UJT, FET, MOSFET principles and triggering. 63. Construction and working of SCR, DIAC, TRIAC and IGBT. 64. Phase control methods and gating circuits.
WEEK 24	Waveform Analysis & Digital Logic: 55. Operate and set required frequency using function generator. 56. Generate and demonstrate wave shapes for voltage and current using CRO. 57. Construct variable DC stabilized power supply using IC. 58. Practice on various logics by use of logic gates and circuits.	65. Working principle and applications of Oscilloscope (CRO) and Function Generator. 66. Digital Electronics: Binary numbers and codes. 67. Logic gates (AND, OR, NOT, NAND, NOR, XOR), truth tables, combinational circuits.

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WEEK 25	Control Cabinet Components: 59. Design layout of control cabinet, assemble control elements and wiring accessories for local and remote control of induction motor. 60. Forward and reverse operation wiring of induction motor.	Control Panels & Cabinets: 68. Study and understand layout drawing of control cabinet, power and control circuits. 69. Control elements: Isolators, pushbuttons, switches, indicators, MCB, fuses, relays, timers, limit switches.
WEEK 26	Automatic Star-Delta & Sequential Wiring: 61. Automatic star-delta starter control cabinet wiring with change of direction of rotation. 62. Sequential control wiring of three motors.	70. Wiring accessories: Raceways/cable channels, DIN rail, terminal connectors, thimbles, lugs, ferrules, cable ties, grommets. 71. Interlocking techniques and sequential starter control schematics.
WEEK 27	Panel Assembly & Testing: 63. Carry out wiring of control cabinet as per diagram, bunching XLPE cables, channeling, tying. 64. Mount breakers, relays, contactors, timers, install panel instruments and sensors. 65. Test the control panel for its performance.	72. Cable sizing, derating factors, bunching, routing standards in panels. 73. Testing methods for industrial control elements, continuity, insulation, and functional testing.
WEEK 28	Industrial Drives (AC & DC Drives): 66. Perform speed control of DC motor using thyristors / DC drive. 67. Perform speed control and reversing direction of AC motors using thyristors / AC drive (VFD). 68. Construct and test universal motor speed controller using SCR.	Solid State Drives: 74. Working, parameters and applications of AC / DC drive. 75. Speed control of 3-phase induction motor by VVVF / AC Drive (VFD parameter programming). 76. Harmonics and drive protection devices.
WEEK 29	Voltage Stabilizers & Emergency Lights: 69. Assemble circuits of voltage stabilizer and UPS. 70. Prepare an emergency light. 71. Test, analyze defects and repair voltage stabilizer, emergency light and UPS.	Power Backup Devices: 77. Block diagram and working of voltage stabilizer (servo/relay type), emergency light, and UPS. 78. Online vs Offline UPS systems. 79. Fault tracing and preventive maintenance of stabilizers and UPS units.
WEEK 30	Inverters & Battery Chargers: 72. Assemble circuits of battery charger and inverter. 73. Maintain, service and troubleshoot battery charger and inverter. 74. Install an Inverter with battery and connect it in domestic wiring for operation.	80. Block diagram and working of battery charger and PWM/Sine-wave inverters. 81. Inverter changeover circuit, charging section and power switches. 82. Battery selection, AH rating calculation and maintenance.
WEEK 31	Power Generation Plants: 75. Draw layout of thermal power plant and identify function of different elements. 76. Draw layout of hydel power plant and identify functions of different elements.	Generation Systems: 83. Conventional and non-conventional sources of energy and comparison. 84. Power generation by thermal and hydel power plants (layout, major components, cycles). 85. Nuclear and gas power generation brief overview.
WEEK 32	Substations & Distribution Systems: 77. Visit to transmission / distribution substation. 78. Draw actual circuit diagram of substation visited and indicate various components.	86. Transmission and distribution networks, Grid systems. 87. Substation types (indoor/outdoor, AIS/GIS), bus-bar schemes, lightning arresters. 88. Demand factors: Maximum demand, average demand, load factor, diversity factor, plant utility factor.
WEEK 33	Non-Conventional Energy (Solar & Wind): 79. Prepare layout plan and identify elements of solar power system. 80. Prepare layout plan and identify elements of wind power system. 81. Assemble and connect solar panel for illumination.	Renewable Power Generation: 89. Non-conventional generation methods: Solar photovoltaic and Wind energy systems. 90. Solar cell working, solar panels, grid-tied vs off-grid inverters, charge controllers. 91. Wind turbine generators, aerogenerator components.
WEEK 34	Overhead Lines & Insulators: 82. Practice installation of insulators used in HT/LT line for a given voltage range. 83. Draw single line diagram of transmission and distribution system. 84. Measure current carrying capacity of conductor for given power supply. 85. Fasten jumper in pin, shackle and suspension type insulators.	Overhead Transmission Lines: 92. Line insulators (Pin, Strain, Shackle, Suspension type), creepage distance and puncturing. 93. Overhead poles, conductors (ACSR, AAC), and methods of joining aluminum conductors. 94. Sag and tension calculation factors.
WEEK 35	Service Connection & LT Distribution: 86. Erect an overhead service line pole for single phase 230V distribution system in open space. 87. Practice on laying of domestic service line. 88. Install bus bar and bus coupler on LT line.	95. Safety precautions and IE rules pertaining to domestic service connections. 96. LT line clearance standards, service bracket fixing, weather-proof cable laying. 97. Bus-bar trunking systems and bus couplers.

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WEEK 36	Protection Relays: 89. Identify various parts of relay and ascertain operation. 90. Practice setting of pick up current and time setting multiplier (PSM/TSM) for relay operation.	Protective Relays: 98. Types of protective relays (Electromagnetic, Induction type, Static, Numerical). 99. Operating principles of over-current, earth fault, and differential relays. 100. Plug setting multiplier (PSM) and Time multiplier setting (TMS).
WEEK 37	Circuit Breakers: 91. Identify parts of circuit breaker, check operation. 92. Test tripping characteristic of circuit breaker for overcurrent and short circuit current. 93. Practice on repair and maintenance of circuit breaker.	Switchgear & Circuit Breakers: 101. Types of circuit breakers (MCB, MCCB, ACB, VCB, SF6, OCB). 102. Arc production, arc phenomena, and arc quenching mediums. 103. Routine maintenance and contact overhaul of industrial breakers.
WEEK 38	Electric Vehicle (EV) Charging Stations: 94. Demonstrate different EV charger specifications. 95. Perform installation of EV charging Station for Public places. 96. Perform installation of Home EV charging stations.	EV Infrastructure: 104. EV scenario in India and EV charging basic theory. 105. AC vs DC fast charging, CCS, CHAdeMO, Bharat EV chargers. 106. EV charging safety requirements, earthing, isolation, and protection protocols.
WEEK 39	On the Job Training (OJT) / Group Project Work: • Industrial Exposure / Hands-on Project Execution on Power Systems, Drives, and Panel Wiring.	Project Guidance & Review: • Technical Documentation, Project Report Preparation, Viva Voce & Industrial Safety Review.
WEEK 40	On the Job Training (OJT) / Group Project Work: • Industrial Exposure / Hands-on Project Execution on Power Systems, Drives, and Panel Wiring.	Project Guidance & Review: • Technical Documentation, Project Report Preparation, Viva Voce & Industrial Safety Review.
WEEK 41	On the Job Training (OJT) / Group Project Work: • Industrial Exposure / Hands-on Project Execution on Power Systems, Drives, and Panel Wiring.	Project Guidance & Review: • Technical Documentation, Project Report Preparation, Viva Voce & Industrial Safety Review.
WEEK 42	On the Job Training (OJT) / Group Project Work: • Industrial Exposure / Hands-on Project Execution on Power Systems, Drives, and Panel Wiring.	Project Guidance & Review: • Technical Documentation, Project Report Preparation, Viva Voce & Industrial Safety Review.

APPROVAL & SIGNATURES

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Sign of Instructor	Sign of Group Instructor (GI)	Sign of Superintendent / Principal