

INDUSTRIAL TRAINING INSTITUTE

CRAFTSMEN TRAINING SCHEME (CTS)

ANNUAL INSTRUCTIONAL PLAN BREAKUP (42 WEEKS) WIREMAN - FIRST YEAR

(Curriculum as per DGT / CSTARl Guidelines for Wireman CTS Scheme - 1st Year)

Trade Name & Code	WIREMAN (Engineering Trade) - CTS Version 3.0
NSQF Level & Duration	NSQF Level-3 2 Years Duration (First Year - 42 Weeks)
Academic Session	
Instructor Name & Designation	
Group Instructor (GI) Name	
Principal / Superintendent Name	
Institute Name & Address	

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 1	• Visit various sections of the institute and identify installations. • Identify safety symbols, safety signs (Danger, Warning, Caution) and hazards. • Practice elementary first aid, artificial respiration through visual aids. • Demonstrate isolation of electrical supplies and safe rescue of electric shock victim.	1. Occupational Safety & Health: Scope of Wireman trade and career progression. 2. Power sector scenario in India. 3. Safety rules, safety signs for Danger, Warning, Caution and personal safety. 4. Basic first aid, injury prevention, hazard identification and PPEs. 5. Effects of electric current on human body, reasons for electric shock and rescue procedures.
Week 2	• Practice safe firefighting methods in case of electrical fire using visual aids. • Disposal procedure of workshop waste materials. • Use of Personal Protective Equipment (PPE). • Identify trade tools, hand tools and workshop equipment with care and maintenance. • Practice filing, hacksawing and preparation of straight and T-joints on wooden blocks.	1. Electrical fire safety, types of fire extinguishers and firefighting procedures. 2. Disposal procedures of waste materials and workshop emergency response. 3. Introduction to 5S concept and advantages of BIS / ISI standards. 4. Description, specifications, grades and maintenance of fitting tools (files, hammers, chisels, hacksaw blades).
Week 3	• Practice sawing, planing, drilling and assembling for making wooden switchboards. • Practice marking and cutting straight and curved pieces in sheet metal. • Making holes in metal sheets, securing by screws and riveting.	1. Description and application of marking tools (calipers, dividers, surface plate, scribes, punches). 2. Types of drills, drilling operations and drilling machines. 3. Types of wooden joints and carpentry tools used in electrical work. 4. Sheet metal tools, types of rivets and riveted joints.
Week 4	• Prepare a closed cabinet from metal sheet with holes for cables and various fittings. • Workshop practice on drilling, chipping, internal and external threading of various sizes.	1. Sheet metal fabrication processes and safety precautions. 2. Chipping tools, taps and dies for internal and external threading. 3. Use of screw pitch gauge and care/maintenance of metalworking tools.
Week 5	• Demonstrate and identify various types of cables used in domestic, commercial and industrial wiring. • Practice stripping and skinning of single-strand and multi-strand cables. • Measure thickness of wire and cable core using Standard Wire Gauge (SWG) and micrometer.	1. Fundamental terms of electricity and modern electron theory. 2. Properties and classification of electrical conductors, insulators and semiconductors. 3. Types of wires and cables, voltage grading (Low, Medium, High voltage). 4. Current carrying capacity of conductors and wire specifications.
Week 6	• Demonstrate and practice bare conductor joints: Rat tail joint, Duplex cross joint, Knotted type joint and Fixture joints. • Practice Western Union joint on bare conductors.	1. Types of electrical wire joints and their specific practical applications. 2. Mechanical strength, electrical conductivity and requirements of standard joints. 3. Standards of single-core and multi-strand conductor joints.
Week 7	• Practice Britannia straight joint and Britannia Tee joint in bare copper/aluminum conductors. • Practice split bolt connector joints and married joints in stranded conductors.	1. Britannia straight and Tee joints: construction techniques and applications. 2. Voltage grading of insulators and permissible temperature rise in conductors. 3. Precautions in handling overhead conductors and split bolt connectors.
Week 8	• Practice soldering on copper wire joints using soldering iron and suitable flux. • Practice brazing of metals. • Practice crimping cable thimbles and lugs using manual crimping tools. • Fitting of push-fit coaxial plugs and sockets.	1. Solders, composition of soft solders, types of flux and soldering techniques. 2. Brazing procedures, fluxes and safety precautions. 3. Cable lugs, ferrules and crimping techniques. 4. Construction and specifications of coaxial cables and connectors.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 9	• Measure unknown resistance using voltage drop method (Voltmeter-Ammeter method). • Measure resistance using Wheatstone bridge method. • Verify thermal effect of electric current and temperature coefficient of resistance. • Verify Ohm's Law in DC electrical circuits.	1. Introduction to National Electrical Code (NEC 2011). 2. Ohm's Law: statement, mathematical relationship and circuit applications. 3. Resistance: Laws of resistance, specific resistance and effect of temperature on resistance. 4. Wheatstone bridge: working principle, balance condition and resistance measurement.
Week 10	• Measure voltage and current in series and parallel circuits to verify Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL). • Verify characteristics of series-parallel combinations of resistors. • Test open-circuit and short-circuit conditions in series and parallel networks.	1. Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL). 2. Characteristics of series, parallel and series-parallel resistive circuits. 3. Calculation of total resistance, voltage drops and branch currents. 4. Effects and troubleshooting of open circuits and short circuits.
Week 11	• Determine magnetic poles and plot magnetic field lines of a permanent bar magnet. • Wind an electrical solenoid and determine the magnetic effect of electric current. • Demonstrate the generation of mutually induced EMF in coupled coils.	1. Magnetism: Magnetic terms, magnetic flux, flux density and properties of magnets. 2. Electromagnetism: Principles, laws of electromagnetism and right-hand thumb rule. 3. Faraday's laws of electromagnetic induction. 4. Self-induced and mutually induced electromotive force (EMF).
Week 12	• Identify various types of capacitors (electrolytic, ceramic, paper, film). • Practice charging, discharging and testing condition of capacitors. • Group capacitors in series and parallel to obtain required capacitance and voltage rating.	1. Electrostatics: Principle, construction and dielectric materials of capacitors. 2. Types of capacitors, capacitance units and rating specifications. 3. Grouping of capacitors in series, parallel and calculation of equivalent capacitance. 4. Capacitive reactance (X_c) and testing methods for capacitors.
Week 13	• Measure current, voltage, power factor and verify characteristics of R-L, R-C and R-L-C series circuits. • Measure current, voltage and impedance in R-L-C parallel AC circuits.	1. Alternating Current (AC) fundamentals: Cycle, frequency, time period and amplitude. 2. Instantaneous, RMS, average values, form factor and peak factor of sine wave. 3. Inductive reactance (X_L), capacitive reactance (X_c) and impedance (Z). 4. Power factor: active power, reactive power, apparent power and power triangle.
Week 14	• Verify relationship between line and phase voltages and currents in 3-phase Star connection. • Verify relationship between line and phase voltages and currents in 3-phase Delta connection. • Identify wires of a 3-phase 4-wire system and ascertain neutral wire.	1. Comparison and advantages of AC poly-phase systems over DC and single-phase AC. 2. Generation of 3-phase EMF and vector representation. 3. Star (Y) connection: Line vs Phase voltage and current relationships. 4. Delta connection: Line vs Phase voltage and current relationships. 5. Functions of neutral wire in a 3-phase 4-wire system.
Week 15	• Find phase sequence of 3-phase AC supply using a phase sequence meter. • Determine the effect of a broken neutral wire in a 3-phase 4-wire unbalanced load system. • Measure 3-phase power for balanced and unbalanced loads.	1. Phase sequence: Concept, significance and determination using phase sequence meters. 2. Floating/broken neutral in 3-phase 4-wire circuits and its hazards on appliances. 3. Measurement of 3-phase power using one-wattmeter, two-wattmeter and three-wattmeter methods.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 16	- Practice using analog and digital multimeters for measuring resistance, voltage and current. - Practice using Wattmeter, Energy meter, Phase sequence meter and Frequency meter.	- Classification of electrical measuring instruments (indicating, recording, integrating). - Essential operating torques: Deflecting torque, controlling torque and damping torque. - PMMC and Moving Iron (MI) instruments: Comparison and applications. - Relevant Indian Electricity (IE) rules regarding instrument safety.
Week 17	- Demonstrate improvement of power factor using static capacitors in 3-phase AC inductive circuits. - Measure current, voltage and power using a clamp-on meter (tong tester) in 3-phase circuits.	- Causes and disadvantages of low power factor in industrial and domestic installations. - Methods of power factor improvement using power capacitors. - Working principle and applications of clamp-on tong testers.
Week 18	- Practice installation and sealing of single-phase and three-phase energy meters. - Practice collecting meter readings using Meter Reading Instrument (MRI) and study MRI reports.	- Construction, working principle and calibration of single-phase and three-phase energy meters. - Energy meter sealing procedures and prevention of electricity pilferage/tampering. - Meter Reading Instrument (MRI): Description, optical port communication and data analysis.
Week 19	- Study Thermal and Nuclear power plants using charts and visual aids. - Study transmission and distribution systems layouts using single-line diagrams. - Demonstrate renewable energy power plants (Solar PV, Wind, Micro-hydro) using visual aids.	- Overview of electrical power generation: Thermal, Hydro and Nuclear power stations. - Renewable energy sources: Solar power, wind turbines and micro-hydro power plants. - Transmission systems: Primary and secondary transmission voltage levels and conductors.
Week 20	- Visit local distribution sub-station to inspect transformers, bus bars and switchgear. - Demonstrate operation of circuit breakers (ACB, VCB, SF6, OCB) using visual aids. - Identify outdoor, indoor and pole-mounted substations. - Prepare a single-line diagram of the ITI institute electrical supply system.	- Types of distribution systems: Radial, ring main and interconnected systems. - Substation equipment: Lightning arresters, CT, PT, isolators and bus bar arrangements. - Circuit breakers: Working principle and arc extinction in ACB, VCB, SF6 and OCB. - Types of substations: Indoor, outdoor and pole-mounted sub-stations.
Week 21	- Demonstrate and identify components and materials used in electrical earthing installations. - Prepare Pipe Earthing installation as per IS 3043 / IS 732 standards.	- Importance and necessity of earthing in electrical systems. - IE Rules and standards regarding earthing (IS 3043, IS 732). - Pipe earthing: Specifications, dimensions, charcoal/salt layer requirements and funnel arrangement.
Week 22	- Measure earth resistance of pipe earthing using Earth Resistance Tester / Megger. - Practice methods for reducing earth resistance (watering, treatment of soil).	- Earth electrode resistance, soil resistivity and factors affecting earth resistance. - Fall of potential method for measuring earth electrode resistance using earth tester. - Acceptable values of earth resistance for domestic, substation and industrial installations.
Week 23	- Prepare Plate Earthing installation using Copper / GI plate and earth leads. - Measure earth electrode resistance of plate earthing using earth tester.	- Plate earthing: Construction, dimensions of copper and GI plates, depth and filling mixture. - Comparison between pipe earthing and plate earthing systems. - Selection criteria of earthing conductors and protective earth clips.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 24	• Prepare modern Chemical Earthing installation with specialized backfill compound. • Demonstrate Grid / Mesh earthing system using visual aids.	1. Chemical earthing: Maintenance-free earthing, carbon/bentonite conductive compounds. 2. Advantages of chemical earthing over conventional pipe and plate earthing. 3. Mesh/Grid earthing systems used in substations and generating stations.
Week 25	• Practice equipment grounding, body earthing and bonding of metal enclosures. • Test earth leakage currents and tripping functionality using ELCB, RCCB and earth leakage relays.	1. Difference between System Grounding and Equipment Earthing/Bonding. 2. Earth leakage protection: Operating principle of ELCB and Residual Current Circuit Breaker (RCCB). 3. Sensitivity ratings (30 mA, 100 mA, 300 mA) of RCCBs for human and fire protection.
Week 26	• Demonstrate awareness of Circuit Main Earth (CME) and portable safety earths. • Study TT, TN (TN-C, TN-S, TN-C-S) and IT earthing distribution systems.	1. Concept of Circuit Main Earth (CME) and safety precautions using portable earth leads. 2. Classification of earthing systems: TT system, TN-C system, TN-S system and IT system. 3. International earthing codes and standards.
Week 27	• Identify parts, field coils, armature and terminal markings of DC motors and generators. • Carry out wiring and terminal connections of DC shunt, series and compound motors. • Dismantle, inspect and service 3-point and 4-point DC motor starters.	1. DC Machines: Operating principle of DC generator and DC motor, Fleming's rules. 2. Constructional details: Yoke, armature, commutator, brushes, field poles and interpoles. 3. DC Motor Starters: Necessity of starter, working principle and circuit of 3-point and 4-point starters.
Week 28	• Practice routine maintenance of carbon brushes, brush holders, commutator and slip-rings. • Perform speed control of DC shunt motor using Armature control and Field flux control methods. • Demonstrate overhauling and insulation testing of DC machines.	1. Commutation in DC machines, causes of sparking and brush bedding procedure. 2. Speed regulation and speed control methods: Armature voltage control and field flux control. 3. Losses and efficiency in DC machines, overhauling schedule and preventive maintenance.
Week 29	• Identify terminals and parts of single-phase and three-phase transformers. • Carry out polarity test, transformation ratio test, open-circuit (OC) test and short-circuit (SC) test on a single-phase transformer.	1. Transformers: Working principle, mutual induction, EMF equation and transformation ratio. 2. Construction of core-type and shell-type single-phase and three-phase transformers. 3. Transformer testing: Polarity test, open circuit test (core loss), short circuit test (copper loss) and efficiency.
Week 30	• Identify parts and terminals of 3-phase squirrel cage and slip-ring induction motors. • Test continuity and insulation resistance of AC motors using Megger. • Wire up and service AC motor starters: Direct-On-Line (DOL) starter and Star-Delta starter. • Connect and operate Motor-Generator (MG) set.	1. 3-Phase Induction Motors: Principle of rotating magnetic field, construction and types. 2. AC Motor Starters: DOL starter, semi-automatic & automatic star-delta starters, autotransformer starter. 3. Motor-Generator (MG) sets: Construction, operation and power conversion applications.
Week 31	• Identify and draw standard electrical engineering symbols for power and control circuits. • Interpret and draw control and power circuits for lighting systems, fans and single-phase motors. • Practice drawing circuits using relays, contactors, timers and push buttons.	1. Standard electrical schematic symbols as per BIS and IEC. 2. Principles of electrical drafting: Control circuits vs Power circuits. 3. Relay logic, contactor hold-on circuits, push buttons (NO/NC) and timer delay contacts.
Week 32	• Draw schematic and wiring diagrams of fully automatic Star-Delta starter with interlocking contacts. • Read and interpret complex industrial control panel wiring diagrams.	1. Power and control schematic diagram analysis of fully automatic Star-Delta starters. 2. Electrical and mechanical interlocking methods in motor forward/reverse and starter controls. 3. Standards of industrial power distribution network diagrams.

Week No.	Trade Practical (Professional Skills)	Trade Theory (Professional Knowledge)
Week 33	• Wire up basic lighting circuits to control lamps from single and multiple switches. • Calculate connected load of ITI electrical section and determine maximum demand. • Draw schematic of incoming power supply from distribution pole to consumer main switchboard.	1. Domestic electrical wiring systems: Types, comparison and selection criteria. 2. Indian Electricity (IE) rules for domestic installations and National Building Code (NBC). 3. Connected load, maximum demand, diversity factor and load factor calculations.
Week 34	• Identify and inspect wiring accessories: switches, ceiling roses, lamp holders, sockets, fuses, MCB, RCCB. • Prepare test boards, extension boards and distribution boards with proper fuse/MCB protection. • Plot trip-time characteristic curve of MCB and RCCB.	1. Specifications, current ratings and testing of wiring accessories and switchgear. 2. Protection devices: Comparison between fuse, MCB, MCCB, ELCB, RCCB and MPCB. 3. Current rating and voltage drop calculations in sub-circuits.
Week 35	• Practice layout marking using plumb bob, spirit level and water tube level. • Wire up PVC Casing-Capping wiring installation for lamp and socket points. • Wire up Staircase wiring to control one lamp from two positions using 2-way switches.	1. Tools and methods for alignment: Plumb bob, spirit level and wall channeling/chasing. 2. PVC Casing-Capping wiring: Specifications, clip distances, accessories and IE rules. 3. Multi-point switching circuits: Staircase wiring, corridor wiring and godown wiring principles.
Week 36	• Wire up PVC Surface and Concealed Conduit wiring installation. • Wire up conduit wiring to control one lamp from three different places using intermediate switch. • Assemble consumer main board with ICDP switch, energy meter and MCB distribution board. • Perform insulation resistance, polarity and earth continuity tests on complete installation.	1. Conduit wiring systems: Surface and concealed PVC/metallic conduit wiring standards. 2. Permissible points and load limits per sub-circuit (Lighting & Power sub-circuits). 3. Testing of completed installations: Polarity test, insulation resistance test and earth continuity test.
Week 37	• Identify control panel components: DIN rails, PVC trunking, terminal blocks, relays, contactors, ferrules. • Practice cable forming, bundle lacing, ferrule marking and wiring termination inside electrical control cabinets. • Mount circuit breakers, contactors, timers and connect motor control circuit in panel.	1. Control panel layout, DIN rail mounting, trunking channels and cable routing guidelines. 2. Wire harness, ferrule numbering codes and terminal marking conventions. 3. Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) considerations.
Week 38	• Group secondary chemical cells in series and parallel combinations for specified voltage and ampere-hour ratings. • Prepare electrolyte, perform charging of Lead-acid battery and test specific gravity with hydrometer. • Identify solar cell types (mono-Si, poly-Si, thin-film) and calculate series-parallel grouping for solar panel output.	1. Chemical effect of electric current and Faraday's laws of electrolysis. 2. Lead-acid battery: Construction, active materials, chemical reactions during charge/discharge and maintenance. 3. Introduction to Lithium-ion batteries. 4. Solar cells: Photovoltaic principle, types of solar cells and grouping calculations.
Week 39 -42	On the Job Training (OJT) / Group Project Work	On the Job Training (OJT) / Group Project Work
Week 40	On the Job Training (OJT) / Group Project Work	On the Job Training (OJT) / Group Project Work
Week 41	On the Job Training (OJT) / Group Project Work	On the Job Training (OJT) / Group Project Work
Week 42	On the Job Training (OJT) / Group Project Work	On the Job Training (OJT) / Group Project Work

Sign of Instructor

Sign of Group Instructor (GI)

Sign of Superintendent / Principal