

SYLLABUS FOR
WIREMAN
UNDER
CRAFTSMEN TRAINING SCHEME
&
APPRENTICESHIP TRAINING SCHEME
As approved by
GOVERNMENT OF INDIA
In consultations with
THE NATIONAL COUNCIL
VOCATIONAL TRAINING
&
CENTRAL APPRENTICESHIP COUNCIL

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All Trades Syllabi

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General Information

1. Name of the Trade : WIREMAN
2. N.C.O. Code No. : 855.10
3. Entry Qualification : Passed in 10th class examination under 10 + 2 system of education with Science as one of the subjects or is equivalent.
4. Duration of Craftsmen Training : Two Years
5. Duration of Apprenticeship Training : Three Years including one year Basic Training
6. Rebate Ex-ITI Trainees : 2 years
7. Rebate of Apprentices to Workers : 1 : 7

**LIST OF MEMBERS WHO ATTENDED
THE TRADE COMMITTEE MEETING
TO FINALISE THE SYLLABUS
FOR THE TRADE OF
“WIREMAN” UNDER CTS/ATS HELD ON 20.04.95**

Name and Designations (S/Shri)	Organizations
1. S.R. Majumdar Director	CSTARI-Calcutta
2. H. Chatterjee Director	W.B.S.E.B. - Calcutta
3. D. Chakraboti Dy. Director	B.I.S. - Calcutta
4. B. K. Gangopdhyay	C.P.W.D. – Calcutta
5. S.K. Mitra Jt. Chief Elec. Inspector	Dte. Of Electricity West Bangal, Calcutta
6. Soumen Basu Principal	ITI – Tollygunge,
7. K.N. Baske Principal	Kanchrapara Tech. School, E. Rly.
8. R. P. Borthakur	Dte. Of Employment and Training Govt. of Assam
9. R.M. Sinha	CSTARI-Calcutta
10. P.N. Banerjee Jt. Director of Trg.	CSTARI-Calcutta
11. J.K.R. Mukherjee Dy. Director of Trg.	CSTARI-Calcutta
12. R.N. Halder Dy. Directir of Trg.	CSTARI-Calcutta
13. S.P. Chatterjee, Asstt. Director of Trg.	CSTARI-Calcutta
14. J. Singh Asstt. Director of Trg.	CASTARI-Calcutta
15. T.K. Dey	Kanchrapara Tech. School E. Rly.
16. B.K. Chatterjee Trg. Officer	CASTARI-Calcutta
17. A.K. Das Trg. Officer	ATI-Calcutta

Wk No.	Theory	Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
1.	<p>Organisation of the Institute, departments, Various trades & their functions.</p> <p>Types of responsibility to be undertaken, incentives and future planning of the profession.</p> <p>Safety precautions to be observed in the trade during theoretical as well as practical classes.</p>	<p>Visit to the Institute Introduction with the Principal & Other teaching staff.</p> <p>Demonstration of various trade systems involved in the trade.</p>	<p>Introduction to Engineering drawing, Free hand Sketching of St. lines & Simple geometric figures rectangles, circles, polygons etc.</p>	<p>Revision of elementary mathematical process.</p>
2	<p>Description, specification, general care & maintenance common hand tools.</p> <p>Fundamental terms, definitions, and units related to the trade.</p> <p>Wires & Cables – Introduction type, specification (SWG & MM Square) & Use.</p>	<p>Demonstration & Practice in using Trade hand tools</p> <p>Removing of insulation's from assorted wires and cables. Joining practice with single and stranded conductors of diff. wires cables.</p>	<p>Free hand sketching Practice.</p>	<p>Further practice in common fractions, additions, subtraction, division etc.</p>
3.	<p>Definition of conductors, Insulator and semiconductor. Common conductor, Insulators and semiconductors-their shapes, sizes with respect to low, medium</p>	<p>Practice of joins of bare conductors.</p> <ul style="list-style-type: none"> - Britannia st. jt. - Tee, Western union & sleeve. <p>Practice on – Soldering the above joints. Using insulated connectors.</p>	<p>Free hand sketching with dimensions. Sketching to scale and proportionate sketching.</p>	<p>-do-</p>

	and high voltage,			
4.	Soldering definition, propose different percentages of solder used, expl. Of flux. Different fluxes for different purposes on metals, use of resine cored solder, description of crimping equipment. Care & maintenance of blow lamp. Joining of conductors by soldering.	Demonstration & practice in soldering the Aluminum conductor, cable joints. Use of Aluminum flux and Alca 'P' solder. Demonstration & practice in crimping Thimbles of various sizes, with Aluminum conductors. Use of various grader on Aluminum conductor before inserting into terminals.	Reading of simple Blue Prints.	Properties and use of copper Zinc, Lead, tin, aluminum, brass, bronze, solder, timber & rubber.
5.	Explanation of Resistance, specific resistance, voltage, E.M.F.P.D., current, Load of work, circuit open, closed and short ctk.	Demonstration & practice in Connecting simple ctk. With a lamp/a bell, dry cell or battery.	Conventional symbols for electrical accessories used in electrical installations.	Properties and uses of cast iron, wrought iron, plain carbon steel, high speed steel and alloy steel.
6.	OHM's Law- Statement, explanation and illustration. Explanation of voltage drop in ckt, Series and parallel ckt. Relation-I, V, R, W and energy.	Demonstration and verification of OHM's Law, series ckt. Parallel ckt.	Conventional symbols for electrical Insulators.	Decimals - addition, subtraction, multiplication's. Conversion of decimals To common fraction & shop problems.
7.	Explanation of electrical measuring Instruments- Ammeter, voltmeter only. Explanation of work, power energy in D.C. ctk.	Study and use of Ammeter and Voltmeter. Measurement I, V, R & W in DC ctk.	Conventional symbols for various electrical installations.	Menstruation-Areas of rectangles squares, triangles, circles, polygons etc.
8.	Expl. Of energy meters, their use to measure energy both industrial and domestic.	Demonstration & connection of energy meters. Measurement of energy in D.C. and A.C. ctk.	Symbols for Indicating apparatus.	Reduction of common fractions of decimal fractions as applied to shop problems.
9.	Explanation of common electrical	Demonstration & Practice on connecting	Revision	Revision

	accessories with specifications with National Building codes for house wiring, specification and standard. Fuse-explanation types, rating & material.	common electrical accessories in ckts. And testing them series board. Demonstration on Testing & replacement of diff. types of fuses.		
	ACHIEVEMENTS :			
	The Trainees should be able to			
	(a) Make simple Electrical ckts.with Suitable controlling And protecting devices.			
	(b) Select and Connect Ammeter & Volt meter and read Correctly.			
	ALLED TRAINING FITTER			
10.	Introduction to fitting trade safety precautions to be observed. Description of hammers, chisels, steel rule try square etc. and their general care and maintenance.	Chipping and grinding practice, hardening and tempering of chisels.	Symbols for indicating the methods of operations of the instruments & accessories.	Brief description of manufacturing process of steel, copper and Aluminum.
11.	Files-description, type, sizes and grade. Use of files, their care and maintenance. Marking tools-description and use.	Filing practice, filing true to line. Demonstration on use of marking tools.	Free hand sketching of nuts & bolts with dimensions from samples.	Metric system-Metric weights and measurements units & conversion factors.
12.	Description of Hacksaw frames, hacksaw blades their specifications grade etc.	Marking, saving and drilling practice in hand drills and in power drilling machines.	Free hand sketching of rivets and washers with dimensions from samples.	Meaning of – Tenacity, elasticity, malleability brittleness, hardness, compressibility and ductility with illustration.
13.	Description of taps and dies, types of rivets and riveted joints.	Practice in using taps and dies. Threading hexagonal and square nuts. Cutting external threads on stud and pipe, cutting and riveting practice.	Free hand sketching screws threads with dimensions from samples.	Shop problems on metric system of weight and measurement.
	ACHIEVEMENTS : The Trainees should be Able to :			
	(a) Mark according to the given sketch.			
	(b) File the given job With an accuracy of 0.025 mm.			
	(c) Drill and tap a hole.			
	CARPENTRY			

14.	Description of carpenter's Hand tools – Saws, Planer, Chisel, their care and maintenance.	Sawing and planing practice. Practice in using farmer chisel. Preparation of simple half lap, mortise and dovetail joints.	Free hand sketching of various joints.	Effects of alloying metals.
15.	Timber-Description, seasoning process, use for different purposes. Introduction to wooden poles and battens, finishing and polishing materials and their process.	Making single and double rectangular boards, Making wooden distribution box using dovetail joints. Practice in using sand paper and polishing. Pasting of sunmica on electrical body.	Explanation of simple orthographic projection – 1st angle.	Square root of perfect square of a whole number and a decimal.
16.	SHEET METAL Introduction of sheet metal worker's common hand tools, sheet and wire gauges, Pipe and pipe fittings. Description of simple soldering and brazing common joints.	Demonstration and practice of simple sheet metal work, cutting, bending, joining. Joining of metals by soft soldering. Making simple sheet metal articles.	Explanation & practice of simple orthographic projection – 3rd angle.	Mass & weight – definition, units, interrelation & shop calculation.
	ACHIVEMENT :	The Trainees should be Able to make a double Rectangular block simple tray, Bracket and simple Sheet metal articles Related to the trade.		
18.	Different types of widely used domestic Electrical appliances, Their specifications, Construction & uses.	Practice in wiring different domestic electrical Appliances observing I.E Rules.	Views of simple hollow And solid bodies with Dimensions. Use of Different types of lines And symbols for drawing. Drawing symbols and conventions as used in simple Ckt. Diagram . Symbols Used in ckt. Elements And variability.	C.G.S. & F.P.S system Of units of force, weight Etc. their conversion Problems.
19.	Introduction to meg-	Winding/Rewinding of	Symbols used in ckt.	Simple preambles on

	netism and its properties. Explanation of Electro-magnetism-Advantages & uses. Principles of electro Magnetism, cork screw rule. Right hand rule , magnetic Field of current carrying conductor loop, solenoid.	E.M. Coils/calling bells/ Buzzers. Practices in making new heating Elements, replacement Of old ones, testing and Repairs of domestic Appliances.	Element and variability.	work, power, energy.
20.	Principle of Electro-Magnetic Faraday's Law, Lenz's Law- Explanation and illustration. Principle Of AC-Generator. Flemings right hand Rule. Use of slip rings and split rings.	Practice in wiring/ repairing of domestic electrical Appliances. Demonstration on Alternators and parts.	Symbols used in 'Rota-Ting machines and transformers' IS-2032 (Part-IV) 1908.	-do-
21.	Description of the Parts of D.C. Generators. Classification Of Generators self-Excited and separately Excited- their application in practical Field.	Identification of the parts of D.C Generators. Testing and measuring The field and Armature Resistances. Dismantle the D.C. Generator.	Symbols for Motor-Starter IS-2032 (Part IV) 1965	Problems on Standard Algebraic formula. (a) $(a+b)^2$ (b) $(a-b)^2$ etc.
22.	Types and characteristics of D.C. Generators-Series, Shunt and compound, their applications.	Identification of different parts of generators testing fields & Apparatus. Insulation resistance measurements. Building up of voltage and lading generators.	Simple Isometric views of simples objects such as square Rectangular cubes etc.	Meaning and example of friction. Explanation of center of gravity Expla-nation of specific gravity.
23.	Explanation of Armature reaction, Interlopes and communication. Explanation of terms Used in D.C. Motor-Torque, speed Back	Practice in connecting Generators Testing of D.C. Machine by Megger. General maintenance of D.C. machines.	-do-	Brief description of Manufacturing process Of pig iron and cast iron.

	C.M.F. etc. megger. Expl. Of Megger.			
24.	Expl. Of D.C. Motor Starters-3 point and 4 point Protective devices used . Methods of speed control, advantages, disadvantages & Industrial applications.	Testing of D.C. Motor Connecting running and reversing. Study of D.C. Starters Connecting running And reversing. Study of DC starter-3 Point and 4 point speed control D.C. Motors and speed Measurement. Use Revolution counter.	Layout arrangement of D.C. Motor panel with Controlling devices.	Simple problems on Straight and bell crank Levers.
25.	Explanation of minor fault location methods.	Practice in minor fault location.	Drawing of the methods of termination of different types of cables.	Calculation of volume and weight of simples solid bodies. Prism and shop problems
26	Introduction and explanation of electrical systems.			
27	Explanation of ie rules for different wiring systems-both domestic as well as industrial.	Identification of different wiring materials their specifications.	Drawing the diagram showing Aluminum sleeve for jointing copper and aluminum conductors by compression method.	Shop problems on determination of volume and weight of simple bodies.
	Explanation of ckts. Branching max. load/ckt./way as per rules.	Practice in fixing & connoting wiring accessions such as witch's, plugs, lamp holders etc.		
28	Fundamentals of A.C. different rearms used.	Lay our marking on wiring board a on lamp control by one SP switch. (b) two lamps control by two independent switches. (c) one lamp control by two – ‘Two way setter’. Wooden buttons-PVC single wire.	Reading of simple blue print. Preparing simple wiring circuit diagrams using standard symbols.	Head, temperature-there mimetic scales Fahrenheit, centigrade scales, their conversion. Name and nature of temperature measuring instrument normally used in workshop.
29	General idea of single phase and poly phase	Layout marking on wiring boards,	Exercises on blue print reading.	Meanings of stress, strain, modulus of

	system current power and power factor.	(a) one lamp control by one S.P. switch. (b) Two lamps control by two independent switches. (c) One lamp control by two 'two way switches' by wooden buttons P.V.C. single wire. (d) One lamp control from three different places wing intermediate switch. (e) Domestic wiring practice for room containing three light points, one fan point and one plug point,	Sketching detail of S.P switch.	elasticity and ultimate strength.
30.	Description of different electrical fitting and accessories such as lam holders, switches, plugs brackets, ceiling rose, cut out etc. IS 732-1963	Practice in P.V.C. insulated cable wiring on wood buttons with distribution board and number of circuits.	Exercise on the reading sketching the details of ceiling rose 2 plates and 3 plates.	Geometry-properties of lines, angles, triangles and circles etc.
31	Wiring materials used for P.V.C. cables I.E rules Indian standers regarding the above wiring such as-clip distance fixing of screws, cable bending etc.	Practice on P.V.C. insulated cable wiring on button with distribution board and number circuits with junction boxes, main switches, distribution boards (boxes) two way and intermediate switches.	Free hand sketching of plan and elevation of simple objects like hexagonal bar square bar, circular bar, hollow bar etc.	Factor of safety, Exam place. Different types of stresses with examples.
32.	Description of Rowel tools and Rowel plug, their sizes, plugging, compound, plugs-use of cold chisels hammer, wall jumper their sizes and uses. Introduction to estimation	Demonstration and practice of using Rowel tools of using Rowel tools –do-cold chisels. -do-Cashing and camping wiring.	Free hand sketching of simple objects related trade. Simple working drawings for casing and capping.	Simple problem on lines, angles, triangles and circles. Definition of Vector and sealer quantities with examples.

	procedure. P.V.C. Casing and capping materials used sizes and grades etc. (Deleted).			
33.	Conduit pipe wiring materials and accessories, types and size of conduit.	Demonstration and practice in cutting and threading conduit pipes. Cold and hot bending of pipes Fitting of conduit accessories.	Free hand sketching of wimple object related to trades Preparation of Simple working drawings from sketches Detailed sketching of conduit, fittings.	Effect of force on materials in such as extending, bending, twisting and shearing
34.	Layout of light points, etc. Layout of heating leads etc.-their controls, main switches distribution boards as per I.E. rules. I.E. Rules for earthing conduits using earth clips and earth wire-IS 732-1963	Preparation of conduit frame using different fitting and use of running threads wiring in conduit, using metal clad 3 pin plug, earthing the conduit using earth clips and earth wire.	Sketching of conduit fittings (Contd.)	Trigonometry – Trigonometric function, use of trigonometric tables and applied problems.
35.	Different types of motors used in industry, their normal methods of wiring, controlling starting devices-their connections Layout and earthing of Industrial Wiring	Further practice in conduit wiring. Industrial power wiring to wire a single phase motor with switch & starter.	Sketching the details of D.P.I.C. switch.	Definition of mechanical advantage-velocity ratio related to shop problem.
36.	Explanation of Megger & types use of megger in fault location in wiring system.	Testing of different wiring installations by megger. Insulation earth continuity tests.	Block diagram ckt., diagram if megger.	Useful work of a machine-mechanical efficiency of a machine.
37.	Wiring in workshops, factories and house-their special precautions as per I.E. rules. Knowledge of fire Insurance rules and its applications.	-do-	Sketching of I.C.T.P.	Use of trigonometric Functions and tables.
38.	Define-Earthing its importance. Types of earthing Plate and G.I.	Plate earthing-pipe. Improvement of earthing Measurement	Drawing of the schematic diagrams of plate and pipe earthing	Determination of efficiency of simple machine.

	pipe Methods of making good earthing. Earth Resistance Protection of building, fan lights. IS-732& 2309.	of earth resistance.	as per B.I.S.	
39.	Introduction to estimation of work.	Layout of L.V. AC/DC machine and their panels. Wiring of the Low power A.C./D.C. Machines in / machine in metal conduit system as per I.E. Rules IS-900-1965 & 5124-1969.	Preparation of simple working drawing of different conduit joints as per I.S. Symbols.	-do- like winch, pulley block & compound axles.
40.	-do-	-do-	Exercise on blue print reading. Sketching details of Lamp holder, ceiling rose.	Expl. Of Factor of safety and types of stresses.
41.	-do-	-do-	Reading of connection diagrams.	Calculation of volume, weight of simple bodies.
42.	(Addition) Explanation and layout of wiring for multistoried building as per I.E.Rules	Demonstration and practice of multistoried building wiring layout	Reading of electricals layout drawing of a multistoried building	Logarithm-Use of Logtables for multiplication and division
43	Explanation of general insulating materials used in Electrical Engineering their proportions & specific uses. Classification of insulating materials on the basis of thermal stability. Explanation of insulation Resistance, dielectric strength, factors effecting the choice of insulating materials.	Identification of insulating materials. Tests on insulating materials. Measurement of insulation resistance, of domestic installation and industrial installations.	Practice in reanding panel diagrams. IS-127-1958	Practice in the use of logtables.
44	General idea of fixing meter boards & taking service connecation. Sealing of I.C.cut out	Domestic wiring installations for mixed load, both light and power using meters.	Practice in reading panel diagrams.	Brief description of manufacturing process of pig iron-propertiesand use of pig iron

	<p>& meters as per I.E. Rules. General Electric Appliances using heating effect-their capacities, voltage ranges, calculation of current. I.S. 3961 (part-I) 1967 3961 (part-II) 1967 3961 (part-III) 1968 3961 (part-IV) 1968 3961 (part-V) 1968</p>			
45	<p>Explanation of inter connection wiring circuits in the main building and auxiliary blocks, meter boards and its location. Study of lay out symbol in the preparation of layout diagram</p>	<p>Single core cable use 2 way, intermediate switches</p>	<p>Sketching the details of I.C.D.P&I.C.T.P</p>	<p>Reading of simple graph</p>
46	<p>Explanation of earth Megger. use of earth megger</p>	<p>Demonstration & practice on the use of earth megger.</p>	<p>Sketching of panel board arrangement of A.C. poly phase motor ckt.</p>	<p>-DO-</p>
47	<p>In testing domestic and industrial installation. Use of earth leaking circuit breaker</p>	<p>Demonstration and practice in the use of earth leakage tester.</p>		
48	<p>Causes & remedies for fault in different wiring system</p>	<p>Trouble shooting of different type of wiring</p>	<p>Practice in reading schematic diagrams for A.C. Squirrel cage motor starter and slip ring motor starter.</p>	<p>Meaning of horse power and brake horse power. Simple problems as work, power & energy.</p>
49	<p>Servicing of Electrical fans and regulators. Simple rewinding procedures of fans and F.H.P. motors, as per I.E. Rules.</p>	<p>Practice in servicing fans, regulators, simple rewinding for fans and F.H.P. motors.</p>		
50	<p>.....REVISION.....</p>			
...				
to				

52.....TEST.....				
<p>ACHIEVEMENTS: At the end of one year, the trainees should be able to :</p> <p>wiring</p> <p>1: Wire up various electrical fittings both domestic & industrial in desired system as per I.E. rules.</p> <p>2: connect and use voltmeters, Ammeters, energy meter and meggers.</p> <p>3: Test, connect and run D.C. machines and can repair faults, in any wiring system.</p> <p>Second year</p>				
53 to 55	Description of parts & correct use of threading devices.	Practice of cutting & threading of conduit/PVC. Practice in fitting conduit frames using coupling, bends, tees and junction boxes to correct dimensions. Practice in conduit wiring.	Practice in drawing the schematic diagram of an A.C. motor starter and contact type starter.	Calculation of volume, weight of simple solid bodies by using logarithm. Problems on mensuration.
56 to 57	Discussion for charts and tables for size and number of cables to be drawn through conduits of various sizes as per I.E. rules. Earthing of conduit for both surface and concealed systems as per I.E. rules. Methods of drawing cables through conduit.	Identification of P.V.C. conduit spares with specification. Practice on P.V.C. conduit wiring for domestic purpose.	The schematic diagram of an A.C. Sq. cage motor star / Delta starter. And D.O.L. starter.	Practice in using log tables for multiplication division etc.
58.	Fundamentals of A.C. single phase system- Effects of poor P.F. and its improvement.	Test on A.C. ckts, to find out I, V, Z and P.F. for various loads. Expts. To find improvement of P.F.	Drawing schematic diagram of plate & pipe earthing as per IS-3943-1966.	Brief description of manufacturing process of cast iron-properties uses of cast iron.
59.	Calculation of impedance power and power factor-simple examples.	-do-	-do-	-do-
60 to 62.	Introduction to A.C. Poly phase system- advantages, 3 phase star delta. Connection and their relations w.r.t. current and voltage.	Test on 3 phase ckts.- currents and voltage measurement in star and delta connections. Measurement A.C. 3 ph. Power.	Sketching of fittings for rigid non-metallic conduit-Elbow, Tee, Bend, Circular box etc.	Use of Log tables.

	Principle of measurement of A.C. 3 phase ckt. Parameter-I, V, Z & P.F. etc.	A.C. motor panel wiring (slip ring Induction type)		
63 to 64. to 66	Principle of poly phase induction motor-types, their characteristics and industrial applications. Description of D.O.L. Starter. Description of starter delta starter (box manual and Auto.) Internal arrangement of a motor resistance starter for slip ring ind. Motor. Motor control ckt. And starting devices.	Identification and testing of A.C. poly phase motor terminals. Study of D.O.L. Starter. Study Star/Delta starter. Connection of star/Delta starter with 3 ph. Motor and run full load.	-Do- D.D.A. I.S. 3419-1965 Schematic diagram of magnetically operated A.C. motor starter with push button control.	Brief description of manufacturing of steel.
67.	Principle of transformer – constructional features – voltage, current & turns ratio.	Tests on transformer : (a) Single Phase (b) Three Phase	-Do- D.C. motor series contractor starting sketching.	Properties of insulating oil. (Net)
68.	Construction & connection of 3 phase transformer. General idea of efficiency and regulation.	Regulation of transformer.		
69.	Explanation of losses and efficiency of a transformer, knowledge about temperature rise and cooling methods. General procedure of testing a new transformer before commissioning.	Demonstration of temperature indicating & controlling of transformer. Tests of a transformer 1 ph/3 ph. Demonstration of general care and maintenance of transformer. Tests on Auto transformer.	Draw the typical rating plate of a transformer.	Calculation on area, volume and weight of simple solid bodies such as cubes, parallel etc. Application to shop problems.
70.	Principle of E.M.F. Generation Expl. Of Alternator types.	Identification of Alternator of parts. Running of Alternator by primover and	Drawing of the typical terminal plates of transformer s upto 100 K.A.	Properties and uses of lead, tin, zinc, brass, bronze, high carbon steel and alloy steel. Properties

		loading it to find out regulation of various loads.		of matter, molecules, atom, Difference between mass and weight.
71.	General idea of loading and regulation of Alternator.			
72 to 73	Explanation of – Different types of switches and switch gears- multi range switches, rotary switches, cooker control panels, power circuit switches, thermostat, mercury switches etc. M.C.B., M.C.D., E.L.C.B. etc.	Demonstration and tests on Multirange switches, Rotary switches. Cooker control Panel Power ckt. Switches Thermostats. Mercury switches.	Drawing the diagram of current transformer.	Problems on mensuration.
74. & 75.	General idea about overhead distribution (L.V. & M.V.) and their types of accessories used. General arrangement and maintenance of outdoor type of substation.			
76. to 77.	Explanation of over head bus bar, side bus bar. Bus trunking and rising mains. I.E. rules regarding panel erection, busbar, spacing busbar chamber, danger boards. Connection of high Voltage metering equipment used with bus bar.	Assembly & testing of the frame for a panel – suitable for motor generator set. I.S. – 3072 Part-II of 1961. Erection of panel board fixing of controlling starting equipment, necessary meters.	Reading of panel board wiring. Drawing of the current transformer. I.S. 2705 Part-I Wiring diagram for drum controller.	Specific gravity Principle of Archimedes relations between sp. Gravity density.
78.	General description of incandescent Lams, types of caps.			
79.	Types of Lams- Vacuum gas filed, coiled coil. Relative	Demonstrations and testing of various lamps Fixing of Various	Wiring diagram for push button control of two speed S.C. motor	Heat-specific heat of solids, liquids and gas, Heat lost and heat

	comparisons, Specifications and perfect uses. H.P. 3V and L.P. MV and their connection diagram SL & PL Lamps.	lamps to match the need	914.	gained. Further problems of mensration and area vol. Etc.
80.	Expl. Of different terms used in illumination in different places, purposes, advantages, qualities of good illumination Types of reflectors, Fittings mounting heights for domestic, industrial & commercial illumination.	Demonstration and practice on different types of reflectors, fittings use for specific need.	Layout diagram of typical sub-station equipment. IS 2274-1963	Problems on Trigonometry.
81.	Explanation of –A.C. single phase motors- Types characteristics and starting devices. Application of single phase motors.	Demonstration and practice on A.C. single phase motors starting/running for specific need.	Wiring diagram of A.C. multi-speed motors.	Trigonometric functions Use of Trigonometric tables. Applied problem such as Calculation of area of triangle etc.
82.	General idea of laying method and jointing, Precautions to be observed and different accessories used for medium voltage termination IS 693-1965.	Demonstration and practice in terminating and U.G cable to a bus bar chamber. Crimping lugs to the conductors of U.G. cable and connection to bus bar Loop connection for other ckt.	Single line diagram of substation feeder.	Resolution of composition of forces. Problems on menstruation.
83.	Explanation of line projecting devices and their general principal. Brief description of connection of places of use.	Demonstration, testing and use of line protecting devise as per I.E. Rules Demonstration testing and use of line protection.	Single line diagram of substation feeder.	Resolution of composition of forces. Problem on mensuration.
84.	Explanation of electrical measuring Instruments-types-brief description and working.	Demonstration and use of Ammeters, volt meters, meggers energy meters, earth tester & multimeter (digital & analog)	Connection of typical over current relay. Wiring of controlling panel for pas senger lift.	Representation of forces by Vectors, simple problems on lifting tackles.

85.	Uses of Ammeters, Volt meters shunts and multipliers, energy meters, megger, Earth tester & multimeter (digital & analog) with specification.	-do-	-do-	-do-
86. & 87.	Common faults, causes and remedies in domestic and industrial wiring installation, Methods of Locating faults.	Fault location and remedy practice both in domestic and industrial wiring. practice in fixing conduit along with the grider, steel structures station etc.	-do-	-do-
88.	Importance and advantage of maintenance. Points to be observed to maintain the installation, preventive maintenance and routine test.		Key diagram of a power station	Domestic and industrial Load calculations.
89. to 90.	Explanation of wiring and earthing of different domestic appliances-electric heater, air circulator, cookers water heater automatic water boiler, bells, signaling equipment, indicators etc.	Demonstration and practice in wiring and earthing different domestic and industrial equipment as per I.E. Rules.	Schematic diagram of bell and indicator wiring Ckt. diagram of different domestic and industrial equipment.	Problems on menstruation. Load calculations for both domestic and industrial system. L
91. & 92	Digital lighting calculation and lighting a response. Simple explanation of elec-	Tests on passive components.	Study of B.I.S. Symbols for	General equilibrium con-

**LIST OF TOOLS AND EQUIPMENTS
(For a batch of 16 trainees)**

SL.No.	Item	Quantity
1	2	3

TRAINEESKIT

1. Combination pliers 200 mm insulated
2. Screw Driver 200 mm
3. Screw driver 100 mm
4. Terminal Screw Driver 75 mm (Connector)
5. Neon Tester 500 volts Pencil bit type
6. Knife D.B. Electrician
7. 600 mm four fold box wood rule
8. Hammer ball pein 0.25 kg.
9. Try Square 200 mm
10. Firmer chisel 12 mm
11. Firmer chisel 6 mm
12. Tenon saw 250 mm
13. Wood Rasp File 250 mm
14. File round (Half) 2nd cut 250mm
15. File round 150 mm
16. Plumb bob 115 grams
17. Bradawl 150 mm x 6mm square pointed
18. Ratchet brace 6 mm capacity
19. Ratchet bit 4 mm and 6 mm
20. Barwood mallet 1 kg. (75 mm x 15 mm)

**SHOPTOOLSSINSTRUMENTS & GENERAL OUTFIT (PER UNIT OF 16
TRAINEES)**

- | | | |
|------|--|---|
| 1. | Pliers side cutting 200 mm | |
| 2. | Pliers flat nose 150 mm | |
| 3. | Pliers round nose 200 mm | |
| 4. | Pliers long nose 200 mm | |
| 5. | Screw driver heavy duty 250 mm | |
| 6. | Screw driver 7 mm x 300mm square blade | |
| 7. | Firmer chisel 25 mm | |
| 8. | Firmer chisel 18 mm | |
| 9. | Mortise chisel 6 mm | |
| 10. | Iron plane 400 mm x 50 mm blade | |
| 11. | Marking gauge | |
| 12. | Bevel square 150 mm | 4 |
| M13. | Cold chisel flat 25 mm x 200 mm | 4 |
| M14. | Cold chisel flat 18 mm x 200 mm | 4 |

15. Hammer ball pein 0.25 kg	4
16. Hammer ball pein 0.25 kg	4
17. Hammer ball pein 1.00 kg	4
18. Hammer Ball pein 0.50kg	4
19. Rawl tool holder & Bit No. 8,10,14,&16	2 each
20. Wall Jumper Octagonal 37 mm x 450 mm and 37 x 600 mm	4 each
21. Center punch 100 mm	2
22. Scriber 150 mm	2
23. Hammer Ball Pein 0.12 kg	2
24. File flat 300 mm rough	4
25. File flat 300 mm 2nd cut	4
26. File flat 250 mm Bastard	4
27. File flat 250 mm smooth	4
28. File half round 150 mm 2nd cut	4
29. File half round 150 mm smooth	4
30. File round 300 mm 2nd cut	4
31. File round 150 mm smooth	4
32. File triangular 150 mm 2nd cut	2
33. Spanner Double ended set of 6	2 sets
34. Adjustable spanner 350 mm	1
35. Foot print Grip 250 mm	2
36. Allen keys	1 set
37. Steel rule 300 mm	4
38. Steel measuring tape 20 meters	1
39. Hacksaw frame adjustable 200 mm to 300 mm	4
40. S.S. Twist Drill 3 mm,5 mm, 6 mm, and 4 mm	2 each
41. Hand auger 12 mm, 15 mm, 18 mm and 25 mm	2 each
42. Spirit level 300 mm	1
43. Electric soldering iron 125 watts 230-250 V	2
44. Electric soldering iron 750 watts 230-250 V	2
45. Blow lamp 1 litre capacity	2
46. Melting pot 200 mm x 150 mm	1
47. Ladle	2
48. Forge with hand blower	1
49. Forge with hand blower	1
50. Conduit die set suitable for 9 mm, 18 mm, 25 mm and 30 mm	4 sets
51. Bench Vice 150 mm	4
52. Bench Vice 100 mm	2
53. Hand Vice 50 mm Jaw	4
54. Rubber gloves 5000 volts	2 Pairs
55. Safety belt with provision for keeping tools	9
56. Ladder bamboo 6 meters	2
57. Tower Ladder 3 meters on tyre wheels	1
58. Portable extension ladder aluminum 6 to 9 meters	1

59. Iron pen 450 mm	2
60. Trawel 150 mm	2
61. Megger 500 volts cum continuity tester	2
62. Voltmeter M.C.O.- 300 volts	1
63. Voltmeter M. C. Multirange 0.70, 150, 300 & 600 V	1
64. Voltmeter M. C. Multirange 0-15, 30, 50 & 75 V	1
65 Voltmeter centre zero 15-0-15 volts	1
66. Voltmeter M. I. multirange 0-150,300,600 V	2
67. Voltmeter M. I. multirange 0-50, 75, 100, 150V	1
68. Ammeter M.I. 0-15 Amp. Panel Board type	2
69. Ammeter M.I. 0-5 Amp. Panel Board type	2
70. Ammeter M.I.O.- Amp. Panel Board type	2
71. Ammeter M.C. O.-1 Amp. Panel Board type	2
72. Ammeter M.C.O.-5 Amp. Panel Board type	2
73. Ammeter M.C. Centre zero 5-0 Amp.	1
74. Single phase K.W.R. meter 5A, 250 V.A.C.	2
75. D. C. Energy meter (ampere hour type) 5A, 250 V	1
76. 3 Phase KW Reg meter 15 A 440 V	1
77. Watt meter Dynamo meter type 5 Amp. And 250 V	1
78. Multimeter 0-5, 100, 200, 500 milliamperes 0-100- 1000, 10000 ohms. 0-150, 300, 600 V AC/DC	1
79. Earth megger 0-10 ohms, 500 V, with all accessories	1
80. Hot wire Ammeter 0-15 Amps.	1
81. Conduit pipe cutting and threading machines adjustable for 15 mm to 30 mm.	1
82. Conduit pipe bending machine, suitable for 15 mm, 18 mm, 25 mm and 30 mm pipe.	1
83. A.C. ceiling fan 1200 mm. Sweep single phase 75 W. 250 V with regulator	
84. Table fan A.C. 400 mm sweep 60 W Single phase 250 V	1
85. Bar magnet	1
86. Horse shoe magnet	1
87. Wheatstone Bridge	1
88. Crippling tool	1 set
89. Rubber matting 2 meters x 1 meter with x mm	2
90. Wiring board on stand 3 meters x 1 meter with 0.5 meter projection on the top	16
M91. Work bench 2.5 x 1.20 x 0.75 meters	2
M92. Steel locker standard size with 8 Drawers in each	2
M93. Almirah 1.8 x 1.2 x 0.45 meters	2
M94. Instructor's chair	1
M95. Instructor's table	1
M96. Demonstration table 2.5 x 1.20 x 0.75 meters	1
M97. Blackboard with easel	1
M98. stools	16

A99. Fire extinguishers	2
100. Metal rack 180 x 150 x 45 cm	1
A101. Fire buckets	4

General machinery

1	2	3
1	Electric Drill machine 6 mm capacity universal type 250 volts	1
2	Electric drill machine 12 mm. capacity 250 volts universal type	1
3	Squirrel cage induction motor 3 H.P.400 V with V with D.O.L. starter	1
4	Squirrel cage induction motor 5 H.P. 400V. with star delta starter.	1
5	D.C. compound 3 H.P. 250V. with 4 point starter and field regulator (Laboratory type).	1
6	D.C. shunt motor 3 H.P. 250 V. with 3 point starter and speed regulator (Laboratory type)..	1
7	Transformer single phase 1 K.V.A. 250/100V	2
8	Capacitor motor 1/4 H.P. single phase 250V	1
9	split phase motor 1/4H.P. single phase 250V	1
10	Universal motor 750W.AC/DC 250V.	1
11	<p>M.G. set consisting of squirrel cage induction motor 5 H.P. V cycles with directly coupled D.C. compound generator. 3K.W. 250V with built in panel board consisting of :</p> <ol style="list-style-type: none"> 1. 3 phase air circuit breakers 2. star Delta Starter (contact type 8 points) 3. Shunk Field Regulator 4. D.C. Circuit breaker 5. Suitable Voltmeters in A.C. &D.C. Side 6. Suitable line ammeters on A.C. and D.C. side 7. Field circuit ammeter 8. Indicating lamps on both the sides (AC &DC) 9. L.F. Oscilloscope 10. Oscillator A.F. 11. Oil testing kit 	<p style="text-align: center;">1 set</p> <p style="text-align: right;">2 nos.</p> <p style="text-align: right;">2 nos.</p> <p style="text-align: right;">1 no.</p>
<p>NOTE: No additional items are required to be provided for the batch working in the second shift except the items under Trainees Tool kit and lockers.</p>		

List of Indian Standards to be followed

Sl. No.	INDIAN STANDARD		PARTICULAS
1	2		3
1 325		1961	Specifications for Three phase Induction Motors.
2	732	1963	Code of practice for Electrical Wiring Installations (voltage not exceeding 650 volts).
3	900	1965	Code of practice for installation and maintenance of induction motors.
4	1180	1964	Specification for out door type three phase distribution transformer up to and including 100KVA-11 KY.
5	1248	1968	Specification for direct acting electrical indicating instruments.
6	1255	1967	Code of practice for installation and maintenance of paper insulated power cable (up to and including 33 kv).
7	1271	1958	Classification of insulating materials for electrical machinery and apparatus in relation to their thermal stability in service.
8	1293	1967	Specification for three pin plugs and socked outlets.
9	1886	1967	Code of practice for installation and maintenance of transformers .
10	2032(pi-II)	1962	Graphical symbol use in Electro- technology (kind of current distribution systems and methods of connection)
11	2032(pi-III)	1962	Graphical symbols used in electro-technology (circuit elements and variability).
12	2032(pi-IV)	1964	Graphical symbols used in electro - technology (Rotating machines and transformers.)
13	2032 (pi-VI)	1965	Graphical symbols used in electro technology (motor starters).
14	2032(pi-VII)	1965	Graphical symbols used in electro-technology (switchgear and auxiliaries).
15	2032(pi-VIII)	1965	Graphical symbols used in electro technology (semiconductor devices)
16	2183	1963	Schedule for high pressure mercury vapour tamp.
17	2274	1963	Code practice for electrical wiring installation (voltage exceeding 650 volts).
18	2667	1964	Specification for fittings for rigid steel

			conduits for electrical wiring.
19	2705(pt-I)	1964	Specification for current transformers (General requirements).
20	3043	1966	Code of practice for Easting..
21	3072	1965	Code of practice for installation and maintenance of switchgear pt. I switchgear (voltage not exceeding 1000 V)
22	3106	1966	code of practice for selection installation and maintenance of fuses (voltage not exceeding 650 V)
23	3202	1965	Code of practice for eliminate profiling electrical equipment.
24	3419	1965	Specification for fittings for rigid non-metallic conduits.
25	3646 (pi. I)	1966	code of practice for interior illumination (principles of good lighting and aspects of design).
26	3854	1966	Specification for switches for domestic and similar purposes.
27	3914	1967	Code of practice for selecting AC induction motor starters (voltage not exceeding 1000V)
28	3961(pt.I)	1967	Recommended current ratings for cables (paper insulated lead sheathed cable)
29	3961(Pt. II)	1967	Recommended current rating for cables (P.V.C. insulated cables)
30	3961(pt. III)	1968	Recommended current rating for cables(rubber insulated cables)
31	3961(Pt. IV)	1968	Recommended current rating for cables(Polythene insulated cables)
32	3961(Pt. V)	1968	Recommended current rating for cables ((P.V.C. unsullied light duty cables).
33	5124	1969	Code of practice for installation and maintenance of AC induction motor starters (Voltage not exceeding 1000V)
34	693	1965	Specification for varnished cambric insulated cables.

SYLLABUS FOR APPRENTICESHIP TRAINING (3 YEAR)

The period of training for this trade is 3 year consisting of basic training for a period of one year and shop training for the remaining period .

(The syllabus for this trade should be considered as a guide for imparting apprenticeship training according to the facilities available in Industry.)

List of operations/skills to be learnt during practical Training which includes Basic Training.

- Note :**
1. All fresher should undergo one year basic training followed by two years Training on the shop floor .The apprentice on the shop floor on those Operations/skills which have been already learnt during Basic Training .
 2. The content of first year of two year training in Industrial Training Institutes in in this trade is exactly same as mentioned in (1) above. The trainees Of Industrial Training Institutes who may be engaged for two year for shop floor training after one year training in Industrial Training Institutes, should be follow the same course for apprenticeship as in (1) above.
 3. The operation/skills marked* would also be taught to the trainees in Industrial Training Institutes in this trade in second year. The ex-Industrial Training Institutes trainees i.e. those who, after completion of two years training in Industrial Training Institutes would engaged for undergoing apprenticeship Training for the remaining period of one year in this trade, should learn the Remaining operation/skills, if, any, on the shop floor during apprenticeship And develop this method of work, speed, accuracy and finish in job, which Should normally consist of operations/skills already learnt by them earlier.

List of Operations/skills to be learnt during Apprenticeship

BASIC TRAINNG-ONE YEAR

- 1 Instruction in safety precaution as applicable to the trade.
- 2 Use of fitter's hand tools-
 - (a) Chipping
 - (b) Filing
 - (c) Sawing
 - (d) Drilling
 - (e) Threading
- 3 Fitting of bolts, nuts and screws
- 4 Riveting
- 5 Operation on power drilling machines
- 6 Grinding of chisels
- 7 Grinding of screw drivers
- 8 Use of carpenter's basic hand tools:
 - (a) Chiselling
 - (b) Sawing
 - (c) Planning
 - (d) Drilling
- 9 Simple joints in works
- 10 Use of nails, screws etc. for wood work
- 11 Finishing and polishing of wooden materials.
- 12 Use of blacksmithy's basic hand tools.
 - (a) Simple forging
 - (b) Hardening and tempering of common smith cutting tools.
- 13 Bending of pipes
- 14 Making channel clam
- 15 Making eye bolt, stay bow U clamp and J clamp.
- 16 Welding and brazing.
- 17 Use of Sheet Metal's hand tools:
 - (a) Simple cutting
 - (b) Bending
 - (c) Jointing
18. Making of sheet metal articles.
19. Use care and maintenance of basic hand tools related to the trade.
20. Making joints using single strand cables.
21. Making joints using multi strand cables.
22. Soldering joints, use of aluminum flux and alca 'P' solder.
- 23 Sweating of conductor with lug.
24. Grill joints on Aluminum and Copper conductor.

25. Use various types of greases on Aluminum conductor .
26. Fixing and connecting of switches, plug, sockets and lamp holders.
27. Use of cut –outs and fuses.
28. Making simple electrical circuits on wooden boards.
29. Use of primary batteries.
30. Use of secondary batteries.
31. Use of Electrical meters:
 - (a) Use of ammeters
 - (b) Use of Voltmeters
 - (c) Use of KWH meters
 - (d) Use of earth testers
32. Verification of Ohm's Law.
33. Use of techno meters.
34. Use of wire gauge .
35. Making heating element.
36. Testing and connecting of domestic appliances and repairing also.
37. Study of electromagnetism induction and preparing a simple electromagnet.
38. Cutting and threading of conduit including conduit wiring .
39. Lay out of lighting, heating and power circuits.
40. Cutting and fixing of T.W. round blocks & casing capping including casing capping wiring.
41. Wiring and installation of meter boards.
42. Cutting and fixing batten including batten wiring .
43. Use of wiring materials for external and internal lighting .
44. Use of wiring materials for heating & power installation .
45. Study of starter.
46. Earthing .
47. Operation and testing of D.C. machines.
48. Operation, general up –keep and maintenance of D.C. Generators.
49. Working to drawing in mm and inches.

SHOP TRAINING-2 YEARS

1. Instruction in safety precautions on the shop floor including first aid and artificial Respiration.
2. Use of primary batteries.
3. Use of Secondary batteries.
4. Wiring and use of fans.
5. Wiring and use lamps.
6. Wiring armoured power cable.

7. Concealed wiring.
8. Wiring three phase energy meter
9. Use of lightening arrestores.
10. Visits to and demonstrations of special lighting circuit in circumstances e.g. stage lighting , auditorium lighting, exhibited lighting etc.
11. Wiring and erection of panel boards.
12. Working to circuit diagram.
13. Estimation of materials.

SYLLABUS FOR RELATED INSTRUCTION

Related Instruction should be imparted to all the apprentices during of training including basic training. The syllabus given for Related Instruction should considered as guide.

The subjects to be thought to the apprentices in Related Instruction.

1. Trade theory
2. Workshop calculation & science.
3. Engineering Drawing.
4. Social Studies.

FIRST YEAR

The content of the syllabus for the apprentices during first year Training should be same as the content of first year of the two years course for the ITI trainees in the trade.

SECOND YEAR

The content of the syllabus for the apprentices during second year training should same as the content second year of the two years course for the ITI trainees in the trade.

THIRD YEAR

1. TRADE THEORY – (3 hours per week or 150 hours per year approx.)

(The number of hours to be spent on the different topics in the trade theory has been indicated. The hours indicated are flexible and are only indicated as a guide.)

1. Safety at work - Accidents do not happen, they are caused. 6 Hours.
2. Revision of the work of previous two years. 15 Hours.
3. Wiring system – (hazardous and non hazardous) and circuits 9 Hours.
 - conduit and cables (including PVC & MIGG) general lay out, arrangement of circuit, position of fuses, loading of cables, looping in wiring systems, joint boxes, multi-point switching, heating circuits, earth connection, earth test, standard specification for wiring, BIS and government specification.
4. Marketing out position, method of fixing conduits, capacities of conduits, tube cutting, loop in connection, concealed wiring, lead covered wiring, soldering and brazing.
5. Temporary wiring for construction work and festive occasions. Rising mains floor wiring roof wiring drawing in cables etc.

6. Meaning of stress, strain, modulus of elasticity ultimate tensile strength, factor of safety and different types of stresses.
7. Descriptive explanation of expansion of solids, liquids and gases due to heat. Brief description of transference of heat – conduction, convection and radiation.
8. Heat and temperature – Thermometric scales – Fahrenheit and Centigrade – Conversion of Fahrenheit scale of the Centigrade and vice-versa. Measurement of temperature. Name and brief description of simple temperature measuring instruments used in the workshop.

III ENGINEERING DRAWING – (2 hours per week or 100 hours per year approx.)

1. Revision of previous two years' work.
2. Advanced blue print reading.
3. More advanced circuit diagrams.
4. Free hand sketching of actual parts of simple objects related to the trade.
5. Free hand sketching of electrical circuit diagrams using standard symbols.
6. Graphical symbols used in electro technology.
7. Drawing of sectional views of armatures, cores, switches, bearing, starters etc.
8. Code of Practice for general engineering drawing according to I.S.I. (IS : 696 – 1960) B/S.

IV. SOCIAL STUDIES – (1 hour per week or 50 hours per year approx.)

The syllabus has already been approved and is same for all the trades.