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SYLLABUS FOR  
**WIREMAN**  
UNDER  
CRAFTSMEN TRAINING SCHEME  
&  
APPRENTICESHIP TRAINING SCHEME

As approved by  
GOVERNMENT OF INDIA

In consultation with  
THE NATIONAL COUNCIL FOR  
VOCATIONAL TRAINING  
&  
CENTRAL APPRENTICESHIP COUNCIL

Issued by  
GOVERNMENT OF INDIA  
MINISTRY OF LABOUR  
DIRECTORATE GENERAL OF  
EMPLOYMENT & TRAINING  
NEW DELHI

1998 (Revised)

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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 its 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 (Wireman)
7. Ratio 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**

<b>Name and Designations (S/Shri)</b>	<b>Organisations</b>
1. S.R. Majumdar Director	CSTARI-Calcutta
2. H. Chatterjee Director	W.B.S.E.B-Calcutta
3. D. Chakraborti, Dy. Director	B.I.S.-Calcutta
4. B.K. Gangopadhyay Ex-Engineer (E)	C.P.W.D.-Calcutta
5. S.K. Mitra Jt. Chief Elect. Inspector	Dte. of Electricity, West Bengal, Calcutta
6. Soumen Basu Principal	ITI-Tollygunge, Calcutta
7. K.N. Baske Principal	Kanchrapara Tech. School, E. Rly.
8. R.P. Borthakur, Dy. Director	Dte. of Employment and Training, Govt. of Assam
9. R.M. Sinha Jt. Director of Trg.	CSTARI-Calcutta
10. P.N. Banerjee, Jt. Director of Trg.	"
11. J.K.R. Mukherjee, Dy. Director of Trg.	"
12. R.N. Halder, Dy. Director of Trg.	"
13. S.P. Chatterjee, Asstt. Director of Trg.	"

14. J. Singh,  
Asstt. Director of Trg.
15. T.K. Dey  
Workshop Instructor
16. B.K. Chatterjee  
Trg. Officer
17. A.K. Das  
Trg. Officer

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CASTARI-Calcutta  
Kanchrapara Tech. School  
E.Rly.  
CSTARI-Calcutta  
ATI-Calcutta

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Theory	Practical	Engineering Drawing	Workshop Calculation & Science
2	3	4	5

Organisation of the Institute, departments, various trades & their functions.

Visit to the Institute Introduction with the Principal & other teaching staff.

Introduction to Engineering drawing. Free hand sketching of St. lines & Simple geometric figures rectangles, circles, polygons etc.

Revision of elementary mathematical process.

Types of responsibilities to be undertaken, incentives and future planning of the profession.

Demonstration of various trade systems involved in the trade.

Safety precautions to be observed in the trade during theoretical as well as practical classes.

1	2	3	4	5
2.	Description, specification, general care & maintenance common hand tools.	Demonstration & Practice in using Trade hand tools.	Free hand sketching Practice.	Further practice in common fractions additions, subtraction, division etc.
	Fundamental terms, definitions and units related to the trade.			
	Wires & Cables—Introduction type, specification (SWG & MM Square) & Use.	Removing of insulations from assorted wires and cables. Joining practice with single and stranded conductors of diff. wires cables.		
3.	Definition of conductors, Insulator and semiconductor. Common conductor, Insulators and semiconductors—their shapes, sizes with respect to low, medium and high voltage, connectors.	Practice of joints of bare conductors. —Britannia st. jt. —Tee, Western union & sleeve. Practice on—Soldering the above joints. Using insulated connectors.	Free hand sketching with dimensions. Sketching to scale and proportionate sketching.	-do-

1	2	3	4	5
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 Aluminium conductor, cable joints. Use of Aluminium flux and Alca 'P' solder. Demonstration & practice in crimping Thimbles of various sizes, with Aluminium conductors. Use of various grader on Aluminium conductor before inserting into terminals.	Reading of simple Blue Prints.	Properties and use of copper Zinc, Lead, tin, aluminium, brass, bronze, solder, timber & rubber.
5.	Explanation of Resistance, specific resistance, voltage, E.M.F., P.D., current, Load or 'work, circuit open, closed and short ckt.	Demonstration & practice in connecting simple ckt. 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.	Demonstration and verification of OHM's Law, series ckt., parallel ckt.	Conventional symbols for electrical Insulators.	Decimals—addition, subtraction, multiplications. Conversion of decimals

age drop in ckt, Series and parallel ckt. Relation-I, V, R, W and energy.

to common fraction & shop problems.

7. Explanation of electrical measuring Instruments—Ammeter, voltmeter only. Explanation of work, power energy in D.C. ckts.

Study and use of Ammeter and Voltmeter. Measurement I, V, R & W in DC ckts.

Conventional symbols for various electrical installations.

Mensuration—Areas of rectangles squares, triangles, circles, polygons etc.

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. ckts.

Symbols for Indicating apparatus.

Reduction of common fractions to decimal fractions as applied to shop problems.

Explanation of common electrical accessories with specifications with National Building codes for house wiring, specification and standard. Fuse—explanation types, rating & material.

Demonstration & Practice on connecting common electrical accessories in ckts. and testing them series board. Demonstration on Testing & replacement of diff. types of fuses.

Revision

Revision

### ACHIEVEMENTS:

The Trainees should be able to:

- Make simple electrical ckts. with suitable controlling and protecting devices.
- Select and connect Ammeter & Volt meter and read correctly.

### ALLIED TRAINING

#### FITTER

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 Aluminium.

Files—description, type, sizes and grade. Use of files, their care and maintenance. Marking tools—description and use.

Filing practice, filing true to & 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, sawing 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 pipes, cutting and riveting practice. Free hand sketching screws and 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.

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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 and a decimal. Square root of perfect square of a whole number and a decimal.

### SHEET METAL

16. Introduction to 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. Mass & weight—Definition, units, interrelation & shop calculation.

**ACHIEVEMENT :** 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 Practice in wiring different domestic electrical appliances Views of simple hollow and solid bodies with dimensions of units of force, weight C.G.S. & F.P.S. system

2	3	4	5
appliances, their specifications, constructions & uses.	es observing I.E. Rules.	sions. 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.	etc. their conversion problems.
Introduction to magnetism 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.	Winding/Rewinding of E.M. Coils/calling bells/buzzers. Practices in making new heating elements, replacement of old ones, testing and repairs of domestic appliances.	Symbols used in ckt. elements and variability.	Simple problems on work, power, energy.
Principle of Electro-magnetic Faraday's Law, Lenz's Law—Explanation and illustration. Principle	Practice in wiring/repairing of domestic electrical appliances. Demonstration on Alternators and parts.	Symbols used in 'Rotating machines and transformers' IS-2032 (Part-IV) 1908.	-do-
2	3	4	5

AC-Generator. Flemings right hand rule. Use of slip rings and split rings.

Description of the parts of D.C. Generators. Classification of Generators self excited and separately excited—their application in actual 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.

Types and characteristics of D.C. Generators—Series, shunt and compound, their applications.

Simple Isometric views of simple objects such as square Rectangular Cubes etc.

Meaning and example of friction. Explanation of centre of gravity. Explanation of specific gravity.

Insulation resistance measurements.  
 Building up of voltage and loading generators.

Explanation of Armature reaction, interpoles and commutation.

-do-

Brief description of manufacturing process of pig iron and cast iron.



2	3	4	5
planation of terms used D.C. Motor-Torque, Megger. Back C.M.F. etc. General maintenance of D.C. machines. Expl. of Megger machines.	Testing of D.C. Motors, connecting running and reversing. Study of DC starters-Connecting running and reversing. Study of DC starters-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.
planation of minor fault ion methods.	Practice in minor fault location.	Drawing of the methods of termination of different types of cables.	Calculation of Volume and weight of simple solid bodies, cubes, parallelepiped, prism and shop problems.

2	3	4	5
uction and explanation of electrical wiring as.	Identification of different wiring materials their specifications-both domestic as well as industrial.	Drawing the diagram showing Aluminium sleeve for jointing copper and aluminium conductors by compression method.	Shop problems on determination of volume and weight of simple bodies.
ation of ckts. hing max. load/ckt./ s per rules. ctive & controlling ories and their uses s.	Practice in fixing & connecting wiring accessories such as switches, plugs, lamp holders etc.	Reading of simple blue print. Preparing simple wiring circuit diagrams using standard symbols.	Head, temperature-thermometric scales-Fahrenheit, centigrade scales, their conversion. Name
amentals of A.C.- ent terms used.	Layout marking on wiring boards (a) one lamp control by one S.P. switch. (b) Two lamps control by two indicators.		

pendent switches. (c) One lamp control by two-'Two way switches'. Wooden buttons-P.V.C. single wire.

and nature of temperature measuring instrument normally used in workshop.

General idea of single phase and poly phase system current power and power factor.

Layout marking on wiring boards,

Exercises on blue print reading. Sketching details of S.P. Switch.

(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 wiring intermediate switch.

(e) Domestic wiring practice for a Room-containing three light points, one fan point and one plug point.

Meanings of stress, strain, modulus of elasticity and ultimate strength.

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Description of different electrical fittings and accessories such as lamp 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 blue print reading sketching the details of ceiling rose 2 plate and 3 plate.

Wiring materials used for P.V.C. cables I.E. rules Indian standards regarding the above wiring such as-clip distance fixing of screws, cable bending etc.

Practice on P.V.C. insulated cable wiring on buttons with distribution board and number of 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.

Description of Rowel tools and Rowel plugs, their sizes, plugging, compound, plugs-use of cold chisels, hammer, wall jumper their sizes and uses. Introduction to estimation procedure

Demonstration and practice of using Rowel tools.

-do- cold chisels.

-do-

Casing and camping wiring.

Free hand sketching of simple objects related to trade. Simple working drawings for casing and capping.

Simple problems on lines, angles, triangles and circles. Definition of Vector and scalar quantities with examples.

ture. P.V.C. Casing and capping materials used, sizes and grades etc. (DELETED).

Conduit pipe wiring materials and accessories, types and sizes 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 simple object related to trades.  
Preparation of simple working drawings from sketches.  
Detailed sketching of conduit, fittings.

Effect of forces on materials in such as extending, bending, twisting and shearing.

Layout of Light points, fan 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 fittings 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.

Different types of motors used in industry, their normal methods of wiring, controlling starting devices—their connections Lay-out and earthing Code practice for 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.

Explanation of Megger & types use of megger in fault location in wiring system.

Testing of different wiring installations by megger. Installation, earth continuity tests.

Block diagram ckt., diagram if megger.

Useful work of a machine—mechanical efficiency of a machine.

Wiring in Workshops, factories and houses—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.

Define—Earthing its importance. Plate earthing—pipe.

Drawing of the schematic

Determination of effi-

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tance. Types of earthing— Plate and G.I. pipe. Methods of making good earthing. Earth resistance— Protection of building, fan lights. IS-732 & 2309.	Improvement of earthing. Measurement of earth resist- ance.	diagrams of plate and pipe earthing as per B.I.S.	ciency of simple ma- chines.
Introduction to estimation of work.	Layout of L. V. AC/DC ma- chines and their panels. Wir- ing of the Low power A.C./ D.C. machines in metal con- duit system as per I.E. Rules. IS-900-1965 & 5124-1969.	Preparation of simple work- ing drawings of different conduit joints as per I.S. Symbols.	-do- like winch, pulley blocks & compound ax- les.
-do-	-do-	Exercises on blueprint read- ing. Sketching details of Lamp holder, ceiling rose.	Expl. of Factor of safety and types of stresses.
-do-	-do-	Reading of connection dia- grams. Preparation of the layout of cinema hall wiring.	Calculation of volume, weight of simple bodies.
20			
2	3	4	5
Addition) Explanation and layout of wiring for multistoried building as per I.E. Rules.	Demonstration and practice of multistoried building wir- ing layout.	Reading of electricals lay- out drawing of a multi- storied building.	Logarithm—Use of Log tables for multiplication and division.
Explanation of general in- sulating materials used in Electrical Engineering, & their proportions & specific uses. Classification of insulating materials on the basis of thermal stability.	Identification of insulating materials. Tests on insulating materials. Measurement of insulation resistance, of domestic instal- lations and industrial installa- tions.	Practice in reading panel diagrams. IS-127-1958.	Practice in the use of log tables.
Explanation of insulation resistance, dielectric strength, factors effecting the choice of insulating materials.			
General idea of fixing me- ter boards & taking service connection.	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—properties and

2	3	4	5
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Sealing of I.C. cut out & 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

Explanation of inter connection wiring circuits in the main building and auxiliary blocks, Meter boards and its locations. Study of lay out symbols in the preparation of layout diagrams.

Single care cable use for 2 way, intermediate master switches.

Sketching the details of I.C.D.P. & I.C.T.P.

Reading of simple graphs.

use of pig iron.

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Explanation of earth megger. Use of earth megger in testing domestic and industrial installations. Use of earth leakage circuit breaker.

Demonstration & practice on the use of earth megger. Demonstration and practice in the use of earth leakage tester.

Sketching of panel board arrangement of A.C. poly phase motor ckt.

-do-

Causes & remedies for faults in different wiring system.

Trouble shooting of different types of wiring.

Practice in reading schematic diagrams for A.C. Squirrel cage motor starter and slip ring motor starter.

Meaning of horse power and brake horse power. Simple problems as work power & energy.

Servicing of electrical fans and regulators. Simple rewinding procedures of fans and F.H.P. motors, as per I.E. Rules.

Practice in servicing fans, regulators. Simple rewinding for fans and F.H.P. motors.

..... REVISION .....

..... TEST .....

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**ACHIEVEMENTS :** At the end of one year, the trainees should be able to :

1. Wire up various electrical fittings both domestic & industrial in desired wiring system as per I.E. rules.
2. Connect and use voltmeters, Ammeters, energy meter and meggers.
3. Test, connect and run D.C. machines and can repair faults, in any wiring system.

**Second Year**

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.

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 sys-

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. & phase reversing magnetic starter. A.C. Square motor star/Delta starter.

Practice in using log tables for multiplication division etc.

And  
D.O.L. Starter.

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ams as per I.E. rules. Methods of drawing cables through conduit.

fundamentals of A.C. single phase system—Effects of poor P.F. and its improvement.

Tests on A.C. ckt. to find out I, V, Z and P.F. for various loads. Expts. to find improvement of P.F.

Brief description of manufacturing process of cast iron-properties uses of cast iron.

Calculation of impedance power and power factor—simple examples.

-do-

-do-

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introduction to A.C. Poly phase system—advantages, star-delta. Connection and their relations w.r.t. current and voltage. Principle of measurement of A.C. 3 ph. power. Simple calculation of A.C. 3 phase ckt. parameter-I, V, Z & P.F. etc.

Tests on 3 phase ckt.—current 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.

2	3	4	5
Principle of poly phase induction motor—types, their characteristics and industrial applications. Description of D.O.L. 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 with full load.	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.
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)
Construction & connection of 3 phase transformer. General idea of efficiency and regulation.	Regulation of transformer.		

2	3	4	5
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, parallelepoid etc. application to shop problems.
Principle of E.M.F. Generation Expl. of Alternator types.	Identification of Alternator parts. Running of Alternator by primover and loading it to find out regulation of various loads.	Drawing of the typical terminal plates of transformers upto 100 K.A.	Properties and uses of lead, tin, zinc, brass, bronze, high carbon steel and alloy steel. Properties of matter, molecules, atom, Difference between mass and weight.
General idea of loading and regulation of Alternator.			
Explanation of — different types of switches and switch gears—multi-	Demonstration and tests on— Multirange switches, Rotary switches	Drawing the diagram of current transformer.	Problems on mensuration.

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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.	Cooker control Panel ckt. switches Thermostats. Mercury switches.		
General idea about overhead distribution (L.V. & M.V.) and their types of accessories used.			
General arrangement and maintenance of outdoor type of substation.			
Explanation of over head bus bar, side bus bar. Bus linking and rising mains. E. rules regarding panel erection, busbar, spacing busbar chamber, danger boards.	Assembly & testing of the frame for a panel-suitable for motor generator set. I.S.-3072 Part-II of 1961.	Reading of Panel board wiring. Drawing of the current transformer. I.S. 2705 Part-I	Specific gravity Principle of Archimedes relations between sp. gravity density.

2	3	4	5
Connection of high Voltage metering equipment used with bus bar.	Erection of panel fixing of controlling starting equipment, necessary meters.	Wiring diagram for drum controller.	
General description of Incandescent Lamps, types of caps.			
Types of Lamps-Vacuum gas filled, coiled coil. Relative comparisons. Specifications and perfect uses. H.P. 3V and L.P. MV and their connection diagram SL & PL Lamps.	Demonstration and testing of various lamps. Fixing of various lamps to match the need.	Wiring diagram for push button control of two speed A.C. motor IS-3914.	Heat-specific heat of solids, liquids and gas. Heat lost and heat gained.  Further problems of men- suration an area vol. etc.
Expl. of different terms used in illumination, standard levels of illumination in different places, purposes, advantages, qualities of good illumination-	Demonstration and Practice on different types of reflectors, fittings use for specific need.	Layout diagram of typical sub-station equipment.	Problems on Trigonometry.



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Types of reflectors, fittings, mounting heights for domestic, industrial & commercial illumination.			
Explanation of A.C. Single phase motors-Types characteristics and starting devices.	Demonstration and Practice on A.C. Single phase motors starting/running for specific need.	Wiring diagram of multi-speed motors.	Trigonometric functions. Use of Trigonometric tables. Applied problems such as Calculation of area of triangles etc.
Applications of single phase motors.			
General idea of laying method and jointing, precautions to be observed and different accessories used for medium voltage termination.	Demonstration and practice in terminating an 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 sub-station feeder.	Resolution of composition of forces. Problems on mensuration.
Explanation of line projecting devices and their general use.	Demonstration, testing and use of line protecting devices	Single line diagram of sub-station feeder.	Resolution of composition of forces. Problems

2	3	4	5
General principle. Brief description of connection of accessories of use.	as per I.E. Rules. Demonstration testing and use of line protection.		on mensuration.
Part-I, Part-II, Part-III, -1961 Part-IV			
Explanation of electrical measuring Instruments-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 passenger lift.	Representation of forces by Vectors, simple problems on lifting tackles.
Uses of Ammeters, voltmeters shunts and multipliers, energy meters, megger, earth tester & multimeter (digital & analog) with specification.	-do-	-do-	-do-
Common faults, causes and remedies in domestic and industrial wiring installations.	Fault location and remedy practice both in domestic and industrial wirings.	-do-	-do-

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tion, Methods of Locating faults.	Practice in fixing conduit along with the grider, steel structures station etc.		

Importance and advantages of maintenance. Points to be observed to maintain the installation, preventive maintenance and routine tests.

Key diagram of a power station  
Domestic and industrial Load calculations.

Explanation of wiring and earthing of different domestic appliances—electric heater, air circulator, cookers water heater automatic water boiler, bells, signalling 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 mensuration.  
Load calculations for both domestic and industrial system.

Digital lighting calculations and lighting a response.

-do-

Simple explanation of elec-

Tests on passive components.  
Study of B.I.S. Symbols for General equilibrium con-

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tron theory, direction of current. Field due to current. Conductor-Semi Conductor-Insulator explanation in the text of current flow. Explanation of Passive components— $R$ , $X_L$ and $X_C$ with specifications. Explanation of semi-conductor devices—Diode, Transistor, W.J.T., F.E.T., S.C.R.	Tests on Diodes. -Transistor S.C.R. W.J.T. F.E.T. Test on power supplies Demonstration and tests on Transistor amplifier.	Passive and Active components. Study of the Basic Amplifier ckts.  -do- Basic power supply.	Conditions for a series of forces acting on a body.   Plotting of points, graphs. Simple equations.
General explanation of power supply—Half wave, full wave Bridge types with filter ckts.	Demonstration and tests on transistor oscillators.	Ckts. -do- Basic Oscillator ckts.	Simple problems on inclinic plane.
General explanation of transistor as Amplifier with biasing. Coupling of Amplifiers.	Study of simple oscillator ckts.		

General explanation of oscillator with configurations with B.I.S. symbols and specifications. Study of simple Amplifier cks. Study of P.C.B. Fault location and repairs simple types.

Explanation of different telephone cables, music channel wiring with specification. Procedure for shielding telephone and music channel wiring.

Demonstration and practice on telephone cable wiring and shielding of cables.

Revision

Reading and plotting of graphs.

INDUSTRIAL VISIT TO DIFFERENT INDUSTRIAL ESTABLISHMENTS.

REVISION OF THEORY/QUESTIONS & ANSWERS

AND PRACTICAL REVISION/PROJECT WORK

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**VI. ACHIEVEMENTS :** The trainees should be able to study any layout diagram and carry out wiring as per I.E. Rules for both domestic and Industrial, to connect low and medium voltage machines. Testing of installations, Locate fault and rectify them. The trainees should be able to wire up decorative lighting for industry and functional activities.

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

Sl. No.	Item	Quantity
1	2	3

### TRAINEES KIT

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 250 mm
15. File round 150 mm
16. Plumb bob 115 grams
17. Bradawl 150 mm × 6 mm square pointed
18. Ratchet brace 6 mm capacity
19. Ratchet bit 4 mm and 6 mm
20. Barwood mallet 1 kg. (75 mm × 15 mm)

### SHOP TOOLS INSTRUMENTS & 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

Sl. No.	Item	Quantity
1	2	3
9.	Mortise chisel 6 mm	
10.	Iron plane 400 mm × 50 mm blade	
11.	Marking gauge	
12.	Bevel square 150 mm	4
M13.	Cold chisel flat 25 mm × 200 mm	4
M14.	Cold chisel flat 18 mm × 200 mm	4
15.	Hammer Ball Pein 0.50 kg.	4
16.	Hammer Ball Pein 0.75 kg.	4
17.	Hammer Ball Pein 1.00 kg.	4
18.	Hammer cross Pein 0.50 kg.	4
19.	Rawl tool holder & Bit No. 8, 10, 14 & 16	2 each
20.	Wall Jumper Octagonal 37 mm × 450 mm and 37 × 600 mm	4 each
21.	Centre 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 metres	1

Sl. No.	Item	Quantity
1	2	3
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 × 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 aluminium 6 to 9 meters	1
59.	Iron pen 450 mm	2
60.	Trawl 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, 150 V	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

Sl. No.	Item	Quantity
1	2	3
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	1
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.	Cripping tool	1 set
89.	Rubber matting 2 meters × 1 meter × 9 mm	2
90.	Wiring board on stand 3 meters × 1 meter with 0.5 meter projection on the top	16
M91.	Work bench 2.5 × 1.20 × 0.75 meters	2
M92.	Steel locker standard size with 8 Drawers in each	2
M93.	Almirah 1.8 × 1.2 × 0.45 meters	2
M94.	Instructor's chair	1
M95.	Instructor's table	1
M96.	Demonstration table 2.5 × 1.20 × 0.75 meters	1
M97.	Blackboard with easel	1
M98.	Stools	16
A99.	Fire extinguishers	2

## 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. 400 V. with star delta starter.	1
5.	D.C. compound 3 H.P. 250 V, 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. 250/100 V	2
8.	Capacitor motor 1/4 H.P. single phase 250 V	1
9.	Split phase motor 1/4 H.P. single phase 250 V	1
10.	Universal motor 750 W.AC/DC 250 V	1
11.	M.G. Set consisting of squirrel cage induction motor 5 H.P. 400 V cycles with directly coupled D.C. Compound generator. 3 K.W. 250 V with built in panel board consisting of :	
	1. 3 phase air circuit breakers	1 set
	2. Star Delta Starter (contact type 8 points)	
	3. Shunk Field Regulator	
	4. D.C. Circuit breaker	
	5. Suitable Voltmeters on 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	2 nos.
	10. Oscillator A.F.	2 nos.
		1 no.

## List of Indian Standards to be followed

Sl. No.	Indian Standard	Particulars
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 transformers upto and including 100 KVA-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 (upto and including 33 KV)
7.	1271	1958 Classification of insulating materials for electrical machinery and apparatus in realition to their thermal stability in service.
8.	1293	1967 Specification for three pin plugs and socket outlets.
9.	1886	1967 Code of practice for installation and maintenance of transformers.
10.	2032 (Pt-II)	1962 Graphical symbols use in Electro-technology (kind of current distribution systems and methods of connection)
11.	2032 (Pt-III)	1962 Graphical symbols used in electro-technology (circuit elements and variability).
12.	2032 (Pt-IV)	1964 Graphical symbols used in electro-technolo-

1	2	3
14.	2032 (Pt-VII)	1965 Graphical symbols used in electro-technology (switchgear and auxiliaries).
15.	2032 (Pt-VIII)	1965 Graphical symbols used in electro-technology (semiconductor devices)
16.	2183	1963 Schedule for high pressure mercury vapour lamp.
17.	2274	1963 Code of 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 Earthing.
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 (Pt. 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 selection AC induction

1	2	3
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 ratings for cables (P.V.C. insulated light duty cables)
33.	5124	1969 Code of practice for installation and maintenance of AC induction motor starters (Voltage not exceeding 1000 V)
34.	693	1965 Specification for varnished cambric insulated cables.

## SYLLABUS FOR APPRENTICESHIP TRAINING (3 YEARS)

The period of training for this trade is 3 years 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 freshers 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 years training in Industrial Training Institutes in this trade is exactly same as mentioned in (1) above. The trainees of Industrial Training Institutes who may be engaged for two years for shop floor training after one year training in Industrial Training Institutes, should 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 be 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 TRAINING –ONE YEAR

1. Instruction in safety precautions 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) Planing
  - (d) Drilling
9. Simple joints in woods.
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 clamp.
15. Making eye bolt, stay bow, U clamp and J clamp.
16. Welding and brazing.
17. Use of Sheet Metal's hand tools :

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 aluminium flux and alca 'P' Solder.
23. Sweating of conductor with lug.
24. Grill joints on Aluminium and Copper conductor.
25. Use various types of greases on Aluminium 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 technometers
34. Use of wire gauge
35. Making heating element
36. Testing and connecting of domestic appliances and repairing also.
37. Study of electromagnetic induction and preparing a simple electro-magnet
- \*38. Cutting and threading of conduit including conduit 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 of 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 the entire period of training including Basic Training. The syllabus given for Related Instruction should be considered as guide.

The subjects to be taught to the apprentices in Related Instruction :

1. Trade Theory
2. Workshop Calculation and 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 I.T.I. trainees in this trade.

#### SECOND YEAR

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

#### THIRD YEAR

##### I. 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 intended as a guide).

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|--|----------|
| 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—conduit and cables (including PVC & MIDD) general lay out, arrangement of circuits, position of fuses, loading of cables, looping in wiring system, joint boxes, multi-point switching, heating circuits, earth connection earth test standard specification for wiring. | 9 hours  |

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|-----|--|----------|
| 4.  | Marking out position, method of fixing conduits, capacities of conduits, tube cutting, loop in connections, concealed wiring, lead covered wiring, soldering and brazing.  | 6 hours  |
| 5.  | Temporary wiring for construction work and festive occasions. Rising mains, floor wiring roof wiring drawing in cables etc.  | 6 hours  |
| 6.  | Different types of switches and switch gears, ceiling roses, fixing, blocks, holders plugs radiator, switches, main switches, thermostat Cooker, Control panels, power circuit switches, mercury switches and motor starters.  | 9 hours. |
| 7.  | Lighting work—checking illumination—incandescent lamps, gas filled lamps, mercury and sodium discharge tubes, fluorescent tubes and knowledge of safety precautions. Lighting regulators (dimmers), types of reflector fittings. Mounting heights & factory lighting. Domestic and Commercial illuminations Architectural lighting.                        | 9 hours  |
| 8.  | Wiring of domestic apparatus—electric wires, air circulators, cookers, water heaters automatic water boilers, bells, signalling equipments, indicators, burglar alarms, electrically controlled clocks, extension loud speakers, refrigerators, Air conditioners etc.  | 9 hours  |
| 9.  | Wiring of industrial apparatus—low voltage adjustment various D.C. machines, motor starters, A.C. motors and generators voltage control, induction motors, star-delta and auto transformers starters, liquid starters, bus-bar system, electric welding and electro plating apparatus, industrial telephones, ventilating system, battery charging meters. | 6 hours  |
| 10. | Repair work—jointing conductors, chasing for conduits, making good in plaster, slugging walls, fixing pendants. Heating and lighting sockets, rewiring industrial installations. Routine maintenance of A.C. and D.C. Motors.  | 6 hours  |
| 11. | Use of tables, data and manufacturers hand books.  | 3 hours  |

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|-----|--|----------|
| 14. | Modern developments in the trade new techniques etc.   | 3 hours  |
| 15. | Inspection – reduction of scrap by stage inspection.   | 6 hours  |
| 16. | Quality and finish of works—Importance of quality and finish of jobs at all stages.  | 6 hours  |
| 17. | Introduction to work simplification related to the trade— job analysis including planning of sequence of operation. Critical approach and method of working. Estimation of time and materials, job handling. | 24 hours |
| 18. | Revision and Test.   |          |

## II. WORKSHOP CALCULATION & SCIENCE—(1 hour per week or 50 hours per year approx.)

1. Revision of the work of previous two years.
2. Mensuration—Perimeters and areas of rectangles, squares, triangles, circles and regular polygons, Calculation of area volume and weight of simple solid and hollow bodies, such as, cube, square, hexagonal prism, cone and sphere—applied problems.
3. Advanced problems on work, power and energy.
4. Determination of weight, diameter and length of different types of wires and cables. Estimation of requirements of materials for layout of house, wiring etc.
5. Meaning of tenacity, elasticity, malleability brittleness, hardness, compressibility and ductility.
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 measuring instruments used in the

**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 electrotechnology.
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.