

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

Issued by
GOVERNMENT OF INDIA
MINISTRY OF LABOUR
DIRECTORATE GENERAL OF
EMPLOYMENT & TRAINING
NEW DELHI
2000 (Revised)

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All Trades Syllabi

Asian Publishers

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Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
1.	Familiarisation with Trade Instructor, of the Trade, Future Prospects etc. Duties and Responsibilities of Trainees, Safety measures to be observed. Elementary first Aid. Concept of Standard & standardirazation.	Visit to the different sections of the Institute. Demonstration of elementary first aid. Artificial Respiration.		
2.	Matter, Atoms- Structure, Importance of Physics-Basic principles-work, energy. Identification of Trade, Hand tools- Specifications and uses, Care and maintenance of hand tools.	Demonstration on Trade hand tools. Identification of simple types-screws, nuts & bolts, chassis clamps, rivets etc.	Freehand sketching of straight lines, rectangles, squares circles, polygons etc.	Electricity and its uses, Electric current positive. Use of switches & fuses. Conductors and insulators. Applied workshop problems involving multiplication and division common fraction, add, subtract, multiplication

				and division and division. Application of friction to shop problems.
3 & 4.	Fundamental of electricity Electrician theory-Solar system- elements, free electrons- Fundamental terms. definitions, units & effects of electric current	Practice in using steel rules, cutting pliers, screw drivers etc. skinning the cables, and joint practice on single strand. Demonstration & Practice on bare conductors such as Britannia, straight, Tee, Western union.	Proportionate free hand sketching with dimensions Reading of simple blue prints.	Do- Properties and uses of copper zinc, lead, tin, aluminum, brass, bronze, solder, bearing metals, timber rubber.
5.	Solders, flux and soldering technique. Resistors types of resistors & properties of resistors.	Practice on solderings measurements of 'R'.	Conventional symbols of Electrical installation	
6.	Expl.definiton and properties of conductors, insulators and semi-conductors. Types of wires & cables standard wire gauge. Classification of wires & Cables Insulation & voltage grades. Low, medium & high voltage Precautions in using various types of	Demonstration and identification of types of cables. Demonstration and identifications of types of cables. Demonstration & practice on standard wite gauge. Safe use of cables and wires. As per I.S. 732-1963- APP-D. Practice in crimping	Do-	Properties and use of cast iron, wrought iron, plain carbon steel, High speed steel and alloy steel. Decimals-add, subtraction, multiplication, conversion of decimals of to common

	cables.	Thimbles, Lugs.		fractions shop problems.
7. & 8.	Common Electrical Accessories, their specifications, Common Insulation materials as per B.I.S. Concept of ckts. – types of ckts as per property, as per current Flow. Ohm’s Law, series and parallel ckts. Kirchoff’s Law Reading of Ammeter and voltmeters only use-of protective devices of ckts-Fuses & their types Earthing ect. Simple problems of ckts. Conception of developments of domestic ckts., Alarm & a switch, A lamp, A fan with individual switches etc. /Two way switch.	Demonstration and Practice on fixing common electrical accessories. Building/Layout/ assemble of small electrical ckts, with common electrical accessories-Reading & Ammeter Voltmeters. Verification & Ohm’s Law Do-of series ckt. Do-of parallel ckt. Practice in testing and connecting domestic appliances.	Do-	Brief description of manufacturing process of pig iron & cast iron. Reduction of common fractions to decimal fractions shop problems.
Achievements: The trainees should be able to make simple ckts with common electrical accessories with domestic electrical appliances for a specified voltage and current.				
9.	Chemical effect of electric current- Principle of electrolysis. Faraday’s Law of electrolysis. Electro chemical	Assembly of a Dry cell Electrodes-Electrolytes. Grouping of Dry cells for specified voltage and current.	Drawing the typical diagram of D-type cartridge fuse, H.R.C. type fuse.	C.G.S. &F.R.S. systems of units of force, weights etc. their

	equivalents. Explanation of Anodes and cathodes.			conversion problems.
10.	Rechargeable dry cell- description. Advantages and disadvantages. Care and maintenance of cells. Grouping of cells of specified voltage & current. Lead acid Cell- description methods of charging- Precautions to be taken & testing equipment.	Preparation of battery charging Testing of cells.	Draw of the typical diagram of plug and socket out lets. Graphical symbols used in electric technology, ckt. Elements.	Ratio & proportion shop problems plotting and reading of simple graphs. Mensuration areas of rectangles squares, Triangles, circles, regular polygons etc. Calculation of areas.
11&12	Lead Acid Cell general defects & remedies. Nickel Cell- description charging. Power & Capacity of cells. Efficiency of cells. Wheat Stone bridge and its application.	Charging of a Lead acid cell, filling of electrolytes- Testing of charging checking of discharged and fully charged battery.	Simple isometric drawings, isometric views of simple objects- squares, rectangles, cubes, rectangular blocks etc. Detailed diagram of calling bell electromagnet etc.	Algebra- algebraic symbols, add, subtract, multiplication & division of expressions involving algebraic symbols. Simple equations & transpositions problems.
Achievement: Trainees should be able to carry out the necessary steps for charging secondary batteries Individually.				

13.	ALLIED TRADES: Marking use of chisels and hacksaw on flats, sheet metal filing, practice, filing true to line.	Introduction of fitting trade. Safety precautions to be observed Description of files hammers chisels, hacksaw frames & blades-their specification & grades. Care & maintainance of steel rule try square & files.	Symbols indicating the method of operation of the instrument and accessories I.S:1248-1968/APP. A.A-6	Brief description of manufacturing process of steel copper and aluminum.
14.	Drilling practice in hand drilling & power drilling machines. Grinding of drill bits.	Marking tools description & use. Types of drills description & drilling machines, proper use, care and maintenance	Free hand sketching of nuts & bolts with dimension form samples.	Metric systems metric weights units- conversion factors.
15.	Practice in using taps & dies, threading hexagonal & square nuts etc. Cutting external treads on stud and on pipes riveting practice.	Description of taps & dies types in rivets & riveted joints. Use of thread gauge.	Free hand sketching of rivets and washers with dimensions from samples.	Meaning of tenacity elasticity, malleability, brittleness, hardness, compressibility and ductility examples.
16.	Sawing and planing practice. Practice in using firmer chisel and preparing simple half lap joint .	Description of carpenter's common hand tools such as saws planes, chisels mallet claw hammer, marking, dividing & holding tools-their care and maintenance.	Free hand sketching of keys and screw threads with dimensions from samples.	Shop problems on metric system or weight and measurement.

17.	Practice in using ships, marking & cutting of straight & curved pieces in sheet metals. Bending the edges of sheets metals. Riveting practice in sheet metal. Practice in marking different joints in sheet metal in soldering the joints.	Description of marking & cutting tools such as snibs shears punches & other tools like hammers, mallets etc. used by sheet metal workers. Types of soldering irons-their proper uses. Use of different bench tools used by sheet metal worker. Soldering material, fluxes and process.	Explanation of simple or ethnographic projection 3rd angle.	Mass-unit of mass force, absolute unit of force. The weight of a body unit of weight shop problems.
<p>Achievements: (1). The trainee should be able to mark according to the given sketch, to file the given job with an accuracy of + 0.25 mm, be able to drill and tap hole.</p> <p>(2) Should be able to use simple carpenters and tools.</p> <p>(3) Should be able to use simple sheet metal workers hand tools.</p>				
18.	Define –magnetism & classification of magnets. Properties, care & maintenance, methods of magnetising magnetic materials. Para & Diamagnets and Ferro magnetic substances.	Tracing the mg. field of a needle & Bar magnetising mg. materials.	Draw the typical symbols used in electrical ckts.	Simple problems on work, power energy.
19.	Principle of electro-magnetism cork-screw rule, right & left hand rules. Mg. field of current carrying conductors and loop. Earth Magnetism Solenoid its property.	Tracing the magnetic field set up by a current carrying conductor and a loop. Tracing the field of an electromagnet and study the variation of field strength by varying current number or turns	Graphical symbols used in electrotechnology, kinds of currents, distribution systems and methods of connections.	Standard algebraic formula $(a+b)^2$ $(a-b)^2$ Simultaneous equations with two unknown quantities.

	Magnetic terms Principle of electro-magnetic Induction, Faraday's Law, Lenz's Laws.	etc. Assembly/winding of a simple electro magnet.		
20.	Expl. types of resistors used in electrical ckts. Factors controlling the 'R' of a material. Specific Resistance variation of 'R' with change of temperature.	Expl. to demonstrate variation of 'R' of a metal with a change of temperature. Concept development Expl on specific resistance of a metal. Connection of a calling bell. Assembly of a calling bell/buzzer and rewinding of its electro magnets. Measure of 'R' by drop method. Series & shunt ckts-use of Ohm meter.	Do-	Meaning of friction, Examples, Meaning of C.G. Examples. Specific gravity-Unit of work power & energy applied problems.
21.	Principle of D.C. Generator. Fleming's right hand rules.			
22.	Explanation of D.C. Generators-function types-parts. E.M.F. equation-self excitation and separately excited Generators-Practical uses. Use of Ohm meter and Megger.	Identification and testing of the parts of D.C. Generators. Demonstration and use of Ohm meter. Demonstration and use of megger.	Lettering-Numbers Alphabets.	Calculation of Volume and weight of simple solid bodies-Cubes squares & hexagonal prisms and Shop problems. Heat and

23.	<p>Types and characters of D.C. generators.</p> <p>Series Generators and types Shunt Generators</p> <p>Compound Generators & types</p> <p>Their applications</p> <p>simple problems on generator types, capacity etc.</p>	<p>Practice indismantling the D.c. generators.</p> <p>Study of the parts of the D.G. Generators.</p> <p>Voltage Building</p> <p>Connecting with panel Board.</p> <p>Measurement of series. Shunt field resistances.</p> <p>Identification of terminals of D.C. Generators.</p> <p>Testing by megger.</p>	<p>Sketching of D.C. 3-point face Plate starter to scale.</p>	<p>temperature.</p> <p>Thermometric scales – centigrade.</p> <p>Fahrenheit scale and their conversion.</p> <p>Name and uses of temperature measuring instruments used in workshop.</p>
25	<p>Define and expl. Armature reaction, interpoles and their uses, connection of interpoles, commutation.</p> <p>Electromagnetic drag. Fleming’s left hand rule. Principal of D.C.motor.</p>	<p>-connection of shunt generators, Measurement of voltages, No-load & characters.</p> <p>-Demonstration on field excitation.</p> <p>-Load character of a series Gen.</p> <p>-Connection of a compound Generator- Voltage measurement commulative and differential Controlling and protecting equipment. No. –load & Load ch. of a compound Gen.</p>	<p>Graphic symbols for rotating m/cs and Transformers</p>	<p>Shop problems on determination of volume and weight of simple solid bodies.</p>

26	Terms used in D.C. motor Torque, speed, Back-e.m.f.etc. Their relations practical application, Related problems.	Demonstration and practice in identification and testing of D.C. motor parts & terminals. Running, speed control and reversing.	-do-	-do-
27	Types characters and practical application of D.C. motors Stating of D.C. motors 3-points & 4points starters.	Study of the characters of D.C. motors. Study of 3 points & 4 points starters. Control of starters with motors.	-do-	-do-
28.	Type's pf speed control, their advantages & disadvantages & industrial applications.	Use of Techometers Revolution counters with stop watch. Routine maintenance.	Free hand isometric sketching of simple objects with dimensions. Sketching of D.C.-4point starter to scale.	-do-
<p>Achievements: 1. Should be able to identify D.C. M./Cs. 2. Should be able to build up voltage in a D.C. Generator. 3. Should be able to connect, test and run a D.C. motor and reverse its direction of rotation by a starter.</p>				
29 & 30 & 31.	<p>Expl. of electrical wirings, importance, I.E.E. rules.</p> <p>Types of wiring both domestic & industrial.</p> <p>-Specification for wiring accessories- Wires cables, buttons etc.</p> <p>IS-732-1963/5</p> <p>Principle of laying out in domestic wiring- testing by megger.</p> <p>C.T.S. system</p>	<p>Fixing of switches, holder plugs etc. in T.W. boards.</p> <p>-Identification and use of wiring accessories.</p> <p>-Practice in C.T.S. wiring with minimum to more number of points.</p> <p>-Use of two way switches Testing of Installation by megger.</p> <p>-Fixing of calling bells/buzzers.</p>	<p>Free hand sketching of simple objects. Layout arrangement of D.C. Generators, control panel.</p> <p>-Do for motors.</p>	<p>Meaning of stress, strain, modules of elasticity, ultimate strength examples.</p> <p>Geometry- properties of lines angles, triangles and circles.</p> <p>Factor of safety</p>

	P.V.C. concealed system maintenance & Repairing data sheet preparation.	Making of test boards & extension boards IS-732-1963/61 Repairing and testing go domestic electrical appliances.		examples, Types of stresses.
32. & 33.	Specification, standards for conduits & accessories, Earthing, laying diagram for Industrial conduit wiring.;	Identification & demonstration on conduits and accessories & their uses cutting & threading laying, earthing, use of flexible conduit & testing by megger. Measurement of earth resistance.	Free hand sketching of plan, elevation, of hexagon, bar, tapered bar, staircase wiring.	Simple problems on lines, angles, tri-angles and circles.
<p>Achievement: Should be able to carryout simple siring ckts. Undertake repairs of domestic wirings and appliance.</p>				
34. & 35.	Comparison D.C. & A.C. Alternating current & related terms frequency, Instantaneous value, R.M.S value Average value, Peak factor, Load factor, form, factor, Generation of sine wave, phase, in phase out phase. Obstructions of A.C. 'R' XI & Xc. Impendence, power factor, Average power, Reactive power. Simple problems on	Demonstration of sine wave, instantaneous values etc. Study of the behaviour of R, XI & Xc in A.C.ckts. both in series and in parallel.	Free hand sketching of simple Geometrical shapes & hollow shapes. Drawing of simple electrical ckts. Using electrical symbols. View of simple solid hollow bodies. Drawing of sine waves.	Effect of force on materials such application as expanding bending, twisting and shearing. Trigonometric tables-Applied problems. Mechanical adgvatantages, velocity ratio. Applied problems.

	A.C. obstructions & T.P. A.P. etc.			
36.	Problems on A.C. ckts. both series & parallel power consumption P.F. etc. Concept of poly-phase Star & Delta connection Line Voltage & phase voltage, current power in a 3 ph. ckt.	Expl. On poly phase ckts. Current, voltage, & power measurement in poly-phase ckts. Measurement of energy in single & poly-Phase ckts.	Views of simple solid hollow bodies. Ckt. diagram of battery charging ckts. With all details of panel board. -do- Blue print reading.	Calculation of areas of triangles, polygons etc. with the aid of trigonometry.
37.	Explanation of Alternator Prime/mover type advantages, parts regulation, phase sequence, specification of alternators & practical places of uses.	Demonstration on alternators, parts voltage Building, load characters & regulation.	Exercise on Blue print reading of connection to motors through Ammeter voltmeter & K.W. meters.	Useful work of machine mechanical efficiency of a machine-problem. Further use of trigonometric function and applied problems. Machines basic principle. Determination of velocity ratio, mechanical advantage & efficiency.
38. & 39.	Explanation & Definition of Transformer, classification C.T., P.T. Instrument and Auto/VARIAC	Identification of types of transformers/. Connection of transformers efficiencies of transformer testing of	Exercises on Blue print reading, tracing the wiring diagram of a alternator & reproducing it in proper sequence with	Logothrithm-use of Logarithmic tables for multiplication & division.

	<p>Construction, parts working, E.M.F. equation efficiencies, parallel operation & poly phase types their connections. Cooling, protective devices. Specification simple problems on e.m.f. equation, turns ratio and efficiency. Special transformers.</p>	<p>transformer parallel operation of transformer. Use of C.T. & P.T. use of Instrument transformer.</p>	<p>protective equipment sketching the synchronizer connections. Free hand sketching of simple objects related to the trades.</p>	<p>Determination of efficiency of simple m/cs. like winch, pulley blocks, wheel and compound axle. Effects of electric current.</p>
40.	<p>Explanation of A.C. motors, comparison with D.C. classification-pulsating field & split phasing. Working principle construction of 1-ph. motors Characters.</p>	<p>Identification of Induction motors (1-ph) squirrel cage type. split phase type capacitor type slip ring type starting of Induction motor – Reversing -Dismantling Assembling.</p>	<p>Diagram of connection to a squirrel cage induction motor. Sketching the connection diagram of controlling & protective devices for Induction motors.</p>	<p>Applied workshop problems involving, use Logarithmic tables. Different forms of energy, heat, mechanical from one to another.</p>
41. & 42.	<p>Single phase motors contd. Split capacitors, repulsion and series motor working principle-parts-characters starting-running & reversing. Stepper motor & Universal.</p>	<p>-do- Demonstration of Stepper & Universal Motor.</p>	<p>Development of winding diagram for a two pole D.C. dynamo or motor. Preparation of working drawing from sketches.</p>	<p>Plotting & reading of simple graphs.</p>
43.	<p>Explanation of Electrical</p>	<p>Demonstration on scales</p>	<p>Sketching of simple objects</p>	<p>Meaning of Horse Power &</p>

44.	measuring Instruments.	meters	related to trades.	Brake horse power. Simple
45.	-types -Forces necessary to work instruments -Moving coil permanent magnet -Moving iron -Range extension -Multimeter -Wattmeter -Energy meter -Frequency meter -Calibration	-Study of M.C.P.M. meter -do-M.I. meter -do-Range extension -do- Multimeter -do-Wattmeter -do-Energy meter -do-Frequency meter -do-Calibration of meter	Sketching of different shapes of coils. Further practice in Blue. Print reading. Drawing development diagram for single phase A.C. motors.	Problems on work power & energy. Calculation of Volume, weight of simple solid bodies by using Logarithm. Further problems on mensuration.
46.	Explanation of light	Study of intensity of lights.		Rectifier Maximum Average
47.	while lights- illumination fact-	-do- Neon Sign	Drawing the development	R.M.S. current in rectifiers
48.	tors, intensity, human eye factor units- types illumination & lamps -Neon sign Halogen, Mercury vapour, sodium vapour, Fluorescent tube -Characters watt ages, fixing places. Types of lighting. Decoration lighting- Drum Switches, Direct & indirect lighting- efficiency in lumens per watt, colour available.	-do-Mercury vapour (H.P & L.P.) -do-Sodium vapor -do-Halogen Lamps -do-Single tube, Double tube. Practice in decoration lighting. -do-S.N. & R.N. Lamps.	diagram for D.C. Simplex Lamp & Wave winding.	from factor ripple factor.

	Thumb rule calculation of lumens. Estimating placement of lights and fans and ratings. Explanation of S.N. and R.N. Lamps.			
49.	REVISION			REVISION
50				
51	T	E	S	T

Achievements: 1. Test and connect domestic electric wiring and appliances.

2. Carryout simple wiring in T.R.S., P.V.C. wires on T.W. button.

3. Install and test the lighting ckts on conduct system on T.W. button as per rules.

4. Test & connect D.C. generators & motor & repair minor faults.

5. Connect, run and reverse A.C. motors.

6. Carrying decoration lighting.

52. & 54.	Techniques, procedures of Layout of conduit wiring as per I.S.-732-1963. Use of flame proof and explosion proof. Installation of P.V.C. conduit switches. Types of Earthing-techniques, their relative advantages.	Installation of conduit pipe wiring for lighting and power circuit for both 230V &440V. Practice in Earthing. -do-in P.V.C. conduit. Measurement of earth resistance & Insulation resistance.	Practice in reading panel diagram. Practice in reading ckts. containing Resistance, Inductances Practice in reading typical examples of ckts. containg R., X & C.	Practice in the use of Logarithmic tables for multiplication, division square, root, cube root. Insulating material including transformer oil. -do- Natural.
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55.	A.C. Winding terms, Arma-	Making foma, coil insulation,	Further practice in Blue	Insulating materials synthetic.
56.	ture winding terms, soil side end coils & grouping of coils, Connection to adjacent poles, connected armature winding, alternate pole connection, armature winding-Lap & wave connected.	slot insulation, Insertion of coils in slots, coil connection- Practice, in single layer concentric winding.	print reading , drawing the development diagram for simple lap & wave winding -do-	Use of Log tables. Brief description & properties of electrical materials silicon, Nechrome silver etc.
57. & 58.	D.C. Winding terms, pole pitch, coil pitch back pitch, Front pitch-Progressive & retrogressive winding.	Winding practice in distributed type, testing for faults, Growler testing-banking impregnating & varnishing.	Tracing wiring diagram of an alternator & reproducing it.	Calculation on area, volume and weight of simple solid bodies such as cubes.
Achievements: 1. Carryout domestic & Power wiring in conduit system and testing earth & earthing. 2. Carryout simple winding, re-winding of detected faults in both D.C.& A.C. M/Cs.				
59.	Revision of A.C. ckts & obstructions & their behaviour in series & in parallel ckts. Measurement of power and power factor & improvement of P.F. in 1-ph and in poly phases.	Expts. On A.C. ckts. 1 ph and poly phase. Expl. On Improvement of P.F. Measuring of power & energy in 1-ph & poly phase. Building up of voltage in an alternator & to find out No load & Load characteristics.	Drawing the schematic diagram of automatic voltage regulators of A.C. generators. Drawing the schematic diagram of A.C. 3-ph reversing magnetic starter. Sketching a breather.	Brief description & properties of electric materials. Problems on mensuration. Forms & properties of matter. The molecule and atoms. Difference between mass and weight.

60. & 61.	Transformer construction cores winding shielding, auxiliary parts-breather, conservator buchltzrelay, other protective devices. Cooling of transformer. Transformer oil testing and top changing off load and on load. Transformer bushings termination.	Cleaning & maintenance of transformer-changing of silicajel. Conducting No-load & short ckt tests. Testing & 1-ph & poly ph. Transformers.	Free hand sketching of transformer & auxiliary part & sectional views.	-do-
62. & 63.	Induction motor Slip Squirrel Cage-Double Squirrel Cage Ind. motor & their Chs. Ship-ring induction motor-Construction & Characters Starting & controlling devices.	Measuring the line & the ph. voltage in star & Data connection. Study of Star-Delta Starter. -do-Automatic -do-Measurement of slip -do-P.F. at various loads.	Drawing the schematic diagram of the starting and controlling gears of slipring & squirrel cage Ind. motor. IS. 3914-1967**	Problems on Mensuration. Atmospheric pressure gauge and absolute pressure.***
64.	Earthing as per I.E. rules Testing & Inspections of Installations as per I.E. Rules. Improvement on earthing IS-3043-1966. Repulsion motor-advantages principle-characters, Fault Location & Rectification.	Testing of Insulation of motor with H.V. Tester. Identification, connection, testing, running & reversing of repulsion motor.	Drawing the schematic diagram of plok & pipe earthing I.S.3043. Wiring diagram of the connecting of arrangement and push button control of two speed AC motor. I.S: 3914-1967.	Density of solids and liquids. Simple expts. On density. Simple problems involving Trigonometric function.
65.	Define-converter-	Starting, running and	Drawing the schematic	Specific

	<p>inverter, M.G. Set- description- Characters, specifications-running & Maintenance.</p>	<p>building up voltage & loading of M.G. set. Maintenance of M.G. sets.</p>	<p>diagram of 4 typical D.C. speed regulators for shunt & compound motors. -do- Magnetic controller with dynamic breaking.</p>	<p>gravity, Archimedes principle. Relation between sp. gravity & density. Problems on trigonometry.</p>
66 & 67.	<p>Working of thermo- couple and its uses, KVAR & max demand indicator. Ferrental type DC energy meter, Ampere-hour meter 3 plds. Energy meters Specifications maintenance & repair.</p>	<p>Study of thermo couple instruments. -do- KVAR meter -do- Max, demand indicator. -do- D.C. energy meter -do- A.C. plan 3 ph. energy meter. Connection of C.T. and P.T. with K.W. and energy meters.</p>	<p>Schematic diagram of magnetically rated. D.C. motor with three push button control station. -do-Luminescent Lamps.</p>	<p>Qty of heat, specific heat of solid, liquid and gases. Heat gained and heat lost. Simple problems on heat gained & heat lost. Further problems on mensuration.</p>
68. & 69.	<p>Insulation materials, their classification, and their uses in industries.</p>	<p>Development of sequence of operation in detecting electrical & mechanical troubles in motors and Generators. Overhauling of A.C. and D.C. m/cs.</p>	<p>Sketching indicting instruments. Drawing the diagram of typical marking plate of distribution transformer. Typical wiring diagram for drum & controller operation of A.C. wound rotor motor.</p>	<p>Resolution & composition of forces. Representation of force by vectors, simple problems on lifting tackles like jib wall, crane-Solution of problems with the aid of vectors.</p>
70 to 74.	<p>Types, specifications, advantages of different</p>	<p>Study of different ckt. breakers.</p>	<p>Layout diagram of a substation.</p>	<p>Examples a simple</p>

	<p>types of circuit breakers construction and maintenance.</p> <p>I.E.E. rules for overhead service lines.</p> <p>Study of U.G. Cables and laying techniques.</p> <p>Working principle and construction of Domestic and agricultural appliances-their maintenance.</p>	<p>Study maintenance & repair of domestic & agricultural equipment.</p> <p>Electric Kettle</p> <p>-do- heater/Immersion</p> <p>-do- hot plate</p> <p>-do-cooking range</p> <p>-do- Incubators</p> <p>-do-Furnaces etc.</p> <p>-Pump set.</p>	<p>Sketching different shapes of coils, sketches indicating possible faults in stator winding. Drawing the development diagram for dupler lap and wave winding brush position.</p>	<p>supported Load.</p> <p>General condition of equilibrium for series of forces on a body.</p> <p>Plotting of point.</p> <p>-do- graph simple Reading and plotting of simple graph.</p>
75	<p>Wiring of light & fan ckts. On rolling stick</p> <p>Installation Lighting arrestor/lighting conductor.</p>	<p>Practice of wiring of lights and fans on rolling stock.</p> <p>Practice of fixing lightening arrestors and lightening conductors.</p>	-do-	<p>Centre of gravity simple expts. for determination, reading and plotting of graphs. Stable, unstable and neutral equilibrium bodies.</p> <p>Friction limitation</p> <p>Laws of friction,</p>
<p>Achievements: Should be able to repair lighting ckts, Horn ckts. etc.</p>				
76.	<p>Study of the arc controlling devices.</p> <p>Explanation and classification & uses of miniature relays & protector devices. Use of electro-magnetic clutches.</p>	<p>Study of miniature relays.</p> <p>-So-Electro-mag. clutches.</p> <p>-do-Mercury Arc 1 ph/poly phase rectifier.</p> <p>-do- Metal rectifier.</p>	<p>Single line diagram of substation feeders</p> <p>Connection diagram of typical overload current relays. Key diagram of a power station.</p> <p>Central controlling panel.</p>	<p>Simple estimation of the requirement of materials etc. as applicable to the trade.</p> <p>Mechanical</p>

	Explanation and principle of operation.			advantages velocity ratio, efficiency of simple pulley wheel screw jack and winch.
: Should be able to install a rectifier and repair the same for minor faults.				
77.	Introduction to electronics- conductor- Insulator- semiconductor energy level atomic structure. ‘P’ & ‘N’ type of materials-P-N- junction. Diode- classification of Diodes- Reversed Bias and Forward Bias.	Identification of semiconductor. Diodes-symbols codes-Tests on Diodes. Characters of Diodes. I.S. 2032 of VIII 1965.	Drawing B.I.S. symbols for electronic components. DIODE, TRANSISTOR Zener diode, S.C.R.I.C. etc.	-do-
78.	Expl. and importance of D.C.	Study of Half wave rectifier	Filling of m/cs history card	Problems as estimation
79 & 80.	Rectifier ckt.-Half wave, Full wave and Bridge ckt. L.E.D. and Solar cells. Filter ckts-passive filter. Expl. and importance of oscilloscope working scope.	-do-Full “ “ -do-Bridge” “ -do-Filter ckts -do-Oscilloscope -do- Different wave shapes and their values.	& maintenance cards and Inventory control card.	
81. to 82.	Expl. of principle of working of a transistor-Types of Transistors, Characters of a transistors, Biasing of Transistors. Mode of use of transistor.	Study of a transistors- Identification of construction and terminals -Tests Study of the characters of	Drawing of B.I.S./I.S.I. symbols for Electronic devices, Drawing of half wave, Full wave & Bridge ckts.	-do-

		transistors.		
83 to 84.	Expl. & Definition of Amplifiers. How a transistor Amplifiers. How a transistor Amplifiers. Signals- Pulse shapers cascade system.	Assembly & testing of a single stage Amplifier and checking in an oscilloscope. Study of Types of wave shapes. -do- Cascade Amplifier.	Drawing ckts for a single stage Amplifiers and Multistage Amplifiers and types of signals.	-do-
85 to 86.	Expl. & definition of oscillator-working principle Explanation of stages and types.	Study of oscillator ckt. Voltage measurement-current. -do- And study wave shapes in scope.	-do-	-do-
87 to 90.	Expl. and working principle and practical applications of U.J.T., F.E.T., S.C.R. Diac & Triac.	Study of simple ckts. contain U.J.T. for triggering -do- Power control ckts by S.C.R. & Triac & Diac	Drawing of ckts containing U.J.T., F.E.T. & Simple power control ckts.	-do-
91 to 92.	Power Supply Stabilizer.	Demonstration on power supply stabilizer.	-do-	-do-
Achievement: Should be able to assemble, test and rectify the faults of simple power supply ckts, amplifiers and control ckts.				
93 & 94.	Complete House wiring Layout. Circuit splitting load wire. I.E.E. rules. “ Multistories house wiring system. Fault finding & repair. Repairing of domestic	Practice in wiring and in maintenance of institute & Hostel building. Layout & repairing of workshop electrical installation.	Drawing of simple Lap and wave winding.	-do-

	electrical appliances.			
95 to 97.	Fault finding techniques in Decoration lighting. -do- Commercial displays -do-Dynamic Generators. etc.	Fault finding practice	-do-	-do-
98.	INDUSTRIAL VISIT & STUDY TOUT			
99 TO 100.	Fault finding in simple electronic ckts. & controls attached in the electrical controls.			
101.				
102 & 103.	REVISION			
104.	TEST			

- Achievements:**
- 1. Carryout domestic wiring for lighting & power as per I.E. rules and test.**
 - 2. Connect, run and Load DC & AC generators and motors and test and rectify the simple fault.**
 - 3. Carryout Battery charging.**
 - 4. Connect, run, test and rectify the faults of domestic electrical appliances.**
 - 5. Carryout armature winding.**
 - 6. Trace out the faults and rectify them of the Auto Wirings.**
 - 7. To identify and trace the simple electronic ckts, test them and replace the Faulty components.**
 - 9. Carryout commercial lighting for decoration etc.**

**SYLLABUS FOR THE TRADE OF ELECTRICIAN
UNDER
APPRENTICESHIP TRAINING SCHEME.**

Period of Training : 3 Years.

- NOTE: 1.** All freshers should undergo one year Basic Training followed by two years training on the Shop Floor. The apprentices should have more practice 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 the Industrial Training Institutes in this trade is exactly the 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 Institute should follow the same course for apprenticeship as in (1) above.
- 3.** The operations/skills marked (*) would also be taught to the trainees in Industrial Training Institutes in this trade in second year. The ex-Industrial Training Institute 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 operations/skills, if any, on the Shop Floor during apprenticeship, develop HIS method of work, speed of operations/skills already learnt by him earlier.

Sl.	List of operations/skills to be learnt during apprenticeship.	No.
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1st Year.

- 1. Instruction in Safety Precautions as applicable to the trade.**
- 2. Use of Fitter's Hand Tools:**
 - (a) Chipping**
 - (b) Filing**
 - (c) Drilling**
 - (d) Threading**
 - (e) Riveting**
 - (f) Polishing**
- 3. Fitting of bolts, nuts and screws.**
- 4. Grinding of drill bits.**
- 5. Use of carpenter's basic tools :**
 - (a) Chipping**
 - (b) Planning**
 - (c) Drilling**
 - (d) Chiselling**

6. Simple joints in wood.
7. Making distribution box using nails screw etc.
8. Use of power drilling machines.
9. Grinding chisels and screw drivers.
10. Use of electrician's basic hand tools.
11. Making of joints using single strand cables.
12. Making of joint using multi strand cable.
13. Sweating of conductor with lugs.
14. Soldering joints.
15. Use of switches, plug, sockets etc.
16. Use of cut-out, fuses, regulators, test lamps etc.
17. Making electrical circuits on wooden boards.
18. Use and testing primary and secondary batteries.
19. Use of electrical meters.
20. Verification of Ohm's Law.
21. Installation of an electrical bell circuits.
22. Installation & testing of light & power, circuits in casing capping, TRS & PVC cables and in conduits.
23. Use of ammeter.
24. *Use of voltmeter.
25. *Use of megger, condenser etc.
26. *Use of wire gauge, tachometer.
27. *Locating & rectifying faults in simple circuits.
28. Use, care, Maintenance and charging of :
 - (a) Primary cells
 - (b) Secondary cells.
29. *Running, care and maintenance of :
 - (a) AC motors and starters-given types.
 - (b) DC motors and starters-given types.
30. *Repair and testing of domestic and electrical appliances.
31. *Use of different types of wire and cables given types.
32. *Use of distribution and fuse boxes.
33. *Use of various types of switches and fitting-given types.
34. * Use, handling and testing of insulation materials.
35. *Connecting up DC/AC motors and generator to starters field regulators, switch boards.
36. *Making of formas and coils.
37. *Winding of low and medium voltage armatures, fields foils and starters.

38. *Use of growlers.
39. *Soft insulation.
40. *Working to circuit diagrams.
41. *Working to drawings in mm/inch.
42. *Care and maintenance of generators.
43. * Repair and testing of generators.
44. *Installation of light circuits for illumination.
45. *Use of gas discharge & GLS lamps.
46. *Use of intermediate and drum switches 2nd & 3rd year.
47. *Instruction in safety precautions on Shop Floor including first aid and artificial respiration.
48. *Cutting and forming of sheet metal.
49. *Making simple sheet metal articles.
50. *Servicing of domestic & agricultural appliances.
51. *Repair and over-hauling of Ac motors.
52. *Repair and over-hauling of electrical meters.
53. *Rewinding of small power transformer.
54. *Making a buzzer/electric bell/transformer.
55. *Testing & rectifying faults in MG set rotary converter and rectifier.
56. *Concealed wiring.
57. *Earthing.
58. *Industrial switch board work.
59. *Care & maintenance of alternators.
60. *Repair and testing of alternators.
61. *Use, care, testing and routine maintenance of transformers.
62. *Electrical installation and erection of machines.
63. *Care, and maintenance of generators.
64. *Repair and testing of generators.
65. Routine maintenance of electrical machines.
66. Maintenance and minor repairs to electronic controls.
67. *Cable jointing and termination.
68. *Drawing overhead service line.
69. *Bus bar connection.
70. *Simple plumbing work.

Note: The operations/skills marked @ are desirable. They must be carried out where facilities are available in the establishment.

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 a for Related Instruction should be considered as a guide.

The subject to be taught to the apprentices in Related Instructions:

- 1. Trade Theory.**
- 2. Working Calculation & Science.**
- 3. Engineering Drawing.**
- 4. Social Studies.**

First Year

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

Second Year

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

Third year

- 1. Trade Theory (3 hours per week or 150 hours per year approximately)**

(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.)

- 1. Safety at work accidents do not happen, they are caused.**
- 2. Revision of the work of previous two years.**
- 3. Composition properties and application of conducting and insulating materials.**
- 4. Making out simple material specification I.S.I. and government specifications- use of reference book, hand book, table etc.**
- 5. Three phase supply.**
- 6. Use of simple electrical formula, elementary calculations in DC system, simple calculation in AC circuits.**
- 7. AC motors and generators-description of the constructional feature of common types of motors and generators.**
- 8. Transformers-principle of working of common types of transformers and description of their constructional features.**
- 9. Motor generating sets and conversion of AC to DC and vice-versa. Description and application of rectifiers.**
- 10. Electrical measuring instruments-description, working principles and construction of volt-meter, ammeter, energy meter, meggar etc. Use, care and maintenance of these instruments.**

11. Cause of voltage fluctuation and necessary measures to ensure satisfactory operation of domestic appliances.
12. Application of electronics to instrumentation, common electronic measuring instruments and controls-Thermionic emission. Thermionic Valves-description and characteristics of diodes and triodes. Use of amplifiers and transistors in instrumentation.
13. General description of transmission systems including high tension grid distribution.
14. Indian Electricity Act and Rules.
15. Trouble shooting sequence.
16. Modern development in the trade-new techniques etc.
17. Quality and finish of work-importance of quality and finish of jobs at all stages.
18. Introduction to work simplification related to trade-job study, analysis including planning of sequence of operation, critical approach and method of working. Estimation of time and material, job handling.
19. Inspection-reduction of scrap by inspection.
20. Revision and test.

II Workshop Calculation & Science (1 hour per week or 50 hours/year approximately)

1. Revision of the work of previous two years.
2. Logarithms: Use of logarithm table for multiplication and division.
3. Mensuration: Area of circle and ellipse, volume and weight of regular cones & spheres. Calculation of area, volume and weight of simple hollow and solid bodies applied problems.
4. Further problem as applicable to the trade.
5. Advanced problem on mensuration, work, power and energy.
6. Determination of weight, diameter and length of different types of wires and cables, Calculation of requirements of materials for lay-outs of house wiring etc.
7. Description explanation of expansion of solids, liquids and gases due to heat-co-efficient of expansion. Brief description of transference of heat conduction, convection and radiation.
8. Meaning of tenacity, elasticity, malleability, brittleness, compressibility and ductility.
9. Meaning of stress, strain, modulus of elasticity, ultimate tensile strength, factor of safety and different types of stress.
10. Arithmetical calculation of torque, speed and horse power of motors.
11. Gear and belt drives. Determination of horse power, speed and size of pulleys and gears.
12. Velocity and acceleration.

III Engineering Drawing (2 hours per week or 100 hours per year approximately)

1. Revision of previous two year's work.
2. Advanced Blue-Print Reading.
3. More advanced circuit diagrams-their reading and drawing.
4. Code of practice for General Engineering Drawing according to ISI: (ISI: 696-1960).
5. Free hand sketching of actual parts of simple objects related to the trade, \.
6. Free hand sketching of electrical circuits and diagrams using standard symbols according to ISI (ISI: 732-1953).
7. Drawing of sectional views of armatures, cores, switches, bearing, stators etc.

IV Social Studies

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

List of Tools & Equipment for the Trade of Electrician

(For a batch of 16 trainees)

Sl. No.	Items	Quantity
Tool Kit		
1.	Rule wooden 4 fold 60 mm	16
2.	Scriber 150 mm X 4mm (Knurled centre position)	16
3.	Pincer 150 mm	16
4.	Pliers insulated 150 mm	16
5.	Screw driver 150 mm	16
6.	Punch centre 150 mm X9 mm	16
7.	Knife double bladed electrician	16
8.	Hammer, cross pein 115 grams with handle	16
9.	Electrician connector, screw driver 100 mm. insulated handle thin stem	16
10.	Electrician testing pencil I Neon Tester	16
11.	Heavy duty screw 200 mm	16
12.	Electrician screw driver 250 mm thin stem insulated handle	16
13.	Rule steel 300 mm	16
14.	Saw tenon 250 mm	16
15.	Hammer ball pein 0.75 kg with handle	16
16.	Firmer chisel wood 12 mm	16
17.	Gimlet chisel wood 12 mm	16
18.	Bradawl	16
19.	Pliers sude cutting 150 mm	16

Shop Tools, Instruments & Machinery

1. C. Clamps 200 mm, 150 mm, 100 mm	1	
2. Spanner 150 mm adjustable 15 degree as cly-burns	2	
3. Blow lamp 0.5 liter	2	
4. Melting pot	1	
5. Ladder	2	
6. Chisel cold flat 12 mm X 200 mm	2	
7. Chisel wood firmer 25 mm and 6 mm	4	
8. Drill machine hand 0 to 6 mm capacity.	2	
9. Electric drill machine portable 6 mm capacity	1	
10. Pillar electric drill machine 12 mm capacity	1	
11. Allen key	1set	
12. Oil can 0.12 liter		2
13. Grease gun	1	
14. Out side micrometer 0 to 25 mm		1
15. Bench grinder motorised		1
16. Rawl plug tool and bit.	2 set	
17. Pull puller	1	
18. Bearing puller	1	
19. Multi meter 0 to 1000 M Ohms 2.5 to 5000 volt	1	
20. Ammeter 1 MA TO 500 MA	1	
21. Ammeter 0 to 1 ammp. DC	1	
22. K.W. meter 0 to 1 K.W. capacity with C.T. 1:2	1	
23. Single phase power factor meter		1
24. Frequency meter	1	
25. Tong tester (Clipon meter)	1	
26. Mill Voltmeter centre zero 100-0-100 m volt	1	
27. Spring balance 0 to 15 kg. and 0 to 2.25 kg.	2 set	
28. Stop watch	1	
29. Techno-meter or revolution counter with stop watch	1	
30. Scissors blade 150 mm	1 set	
31. Crimping tool	4	
32. Screw driver 100mm	4	
33. Chisel cold flat 12 mm	4	
34. Mallet hard wood 0.50 kg.	4	
35. Hammer exetor type 0.40 kg. with handle		3

36. Hacksaw frame 200 mm. 300 mm adjustable `	4 (2 each)	
37. Square try 150 mm, outside & inside caliper	4	
38. Divider 150 mm,outside & inside caliper (each)		3
39. Pliers flat nose 100 mm	4	
40. Pliers Gas round nose 100 mm	4	
41. Pliers Gas 150 mm	4	
42. Tweezers 100 mm	4	
43. Snip straight 150 mm	2	
44. Snip bent 150mm	2	
45. Spanner D.E.W/W standard set	2	
46. Drill hand brace 0 to 100 mm	4	
47. Drill S.S. Twist block 3 mm, 5mm 6mm set of 3	4	
48. Plane, smoothing cutters, 50 mm		4
49. Gauge, wire imperial	2	
50. File flat 200mm 2nd cut.		3
51. File half round 200 mm 2nd cut	4	
52. File half round 200mm smooth	4	
53. File round 200 mm 2nd cut	4	
54. File flat 100 mm 2ndr cut		4
55. File flat 150 mm rough	4	
56. File flat 250 mm smooth		4
57. File flat 250 mm rough	4	
58. File flat 250 mm bastard		4
59. Rasp, half round 200 bastard	4	
60. Iron, soldering 225 grams 125 watt	4	
61. Vice hand 50 mm jaw	4	
62. Stock and dies conduit	1	
63. Ammeter M.C. 0-25 A.D.C.		
64. Ammeter M.C. 0-25 A.D.C.	1	
65. D.C. energy meter 220 V 5A W/H or A/H type	1	
66. A.C. voltmeter M.I. 0-500 V	1	
67. A.C. Ammeter M.I. 0-25 A	1	
68. A.C. Ammeter M.I. 0-5A		1
69. A.C. Energy meter (single phase 5 amp. 230 V)	1	
70. Megger 500 volts	1	
71. Wheat stone bridge complete with galvanometer and battery	1	

72. Fan A.C. 230 volt 1200 mm	2	
73. Fan D.C. 220 volt 1200 mm	2	
74. Bath impregnating	1	
75. Oven stoving	2	
76. Voice, table jaw 100 mm	3	
77. Lockers with 3 drawers(Standard size)	2	
78. Bench working 2.5 X 1.20 X 0.75 meter	4	
79. Almirah 2.5X 1.20 X 0.50 meter	1	
80. Instructor's table	1	
81. Instructor's chair	2	
82. Fire extinguisher		2
83. Fire buckets	4	
84. Metal rack 180 X 150 X45 cm`	4	
85. Wire stripper 20 cm	1	
86. Copper bit soldering iron 0.25 kg		4
87. Domestic appliances:		
(a) Electric hot plate 1500 watt 220 V with temperature control		2
(b) Electric Kettle, 100 watts, 230 V.		2
(c) Electric iron 1200 watts, 230 V with temperature control.		2
(d) Immersion heater 750/1000/1500 W-230 V.	2	
(e) Geyser 25 liter 240 V (storage type)		
(f) B.A. taps and dies 0-2-4-6-8 sizes	1 set	
88. Spring balance 0-1 kg.	1	
89. Laboratory type induction coil 6 Volt to 800-10,000 volt	1	
90. Series type Ohm meter 0-2000 approximate.	1	
91. Shunt type Ohm meter 0-25 approximate		1
92. 3-point D.C. starters	1	
93. 4-point D.C. starters	1	
94. Pipe cutter to cut pipes up to 5 cm dia	4	
95. Pipe cutter to cut pipes up to 5 cm dia	1	
96. Cut out, reverse current, over load voltage relays each		1
97. Stock and die set for 20mm to 5mm G.I. pipe		set
98. Starters for 3-phase,400V, 50 cycles, 2 to 5 H.P. A.C. motors	1	
(a) Auto transformer type starter		
(b) Star delta starter with manual, Semi-auto & Automatic		
(c) Direct on line starter.		

99. Motor A.C. series type 230 V, 50 cycles,

¼ HP with starter and switch

1

100. Electrical machine trainer

Suitable for demonstrating the construction and functioning of different types of DC machines and AC machines (single phase and three phases).

Should be complete with friction brake dynamo meter, instrument panel and power supply units

1 per institute

Sl. No.	Items	Quantity
101.	Scientific Calculator	2 Nos.
	Multi meter	102. 2 Nos.
103.	Motor generator set consisting of: Motor induction squirrel cage, 7 HP 400 volts, 50-cycles, 3-phase with star delta starter and switch directly coupled to DC shunt Generator 5 KW 440 volts, and switch board mounted with regulator, air circuit breaker, ammeter, voltmeter knife blade switches and fuses, set complete with case Iron and plate, fixing bolts, foundation bolts and flexible coupling.	1
104.	Motor generator set consisting of: Motor shunt 5HP, 440 volts with starting compensator and switch directly coupled to generator A.C. 3.5 KVA, 400/2300 volts, 3-phase, 4 wire, 0.3 PF 50 cycles With exciter and 1 switch board mounted with regulator, knife blade switch and Fuses etc. Set complete with cast iron bed blade. Fixing bolts, foundation bolts, & Flexible coupling.	1
105.	Motor service DC, 220 volts, 0.5 to 2 HP, 0.5 to 2HP.	1
106.	Motor shunt DC 220 volts, 2 to 3 HP	2
107.	Motor of AC squirrel cage, 3-phase, 400 volts, 50 cycles, 2 to 3 HP with star Delta starter & triple pole iron clad switch fuse.	1
108.	Motor DC compound-wound 220 volt 2 to 3 HP with starter & switch	1
109.	Motor DC compound-wound, 220 volt 2 to 3 Hp with starter & switch	2
110.	Motor AC single phase, 230, volt, 1 HP repulsion type complete with Starter & switch.	1
111.	Motor AC single phase 230 volt, 50cycles series type with starter/switch 1 HP.	1
112.	Motor AC single phase 230 volt, 50 cycles capacitor type with starter switch 1 HP	1
113.	Motor universal 230 volt, 50 cycles with starter/switch 1 HP	1
114.	Transformer single phase KVA, 230/115 volts, 50 cycles' core type, air cooled With tapings for scd. Connection	3

115.	Transformer three phase, 5 KVA 400/230 volts, 50 cycles, delta and star, shell Type oil cooled	2	
116.	Current transformer		2
117.	Potential transformer		2
118	Used DC generators-series shunt and compound type for overhauling practice		1
each			
119	DC shunt generator, 2.5 KW, 220 v with control panel		
120	DC compound generator, 2.5 KW 250 v with control panel including field rheostat, Voltmeter, ammeter and circuit breaker.		1
121.	Variable auto transformer 0/250 V, % amps.	2	
122	Diesel generator, 5 KVA, with change over switch current circuit breaker, water Cooled with armature, star-delta connections.		1
123	Oscilloscope	1	
124	Function Generator	1	
125.	Oil testing kit		1 no
126	Flux meter	1 no	
127	Stepper motor		1 no
128	Earth leakage ckt. breaker		1 no
129.	Desoldering gum	4 nos.	
130.	A.C.B 5 KVA	1 no	
131	O.C.B 5 KVA	1 no.	
132	M.C.B 5 KVA	1 no	
133	V.C.B 5KVA	1 no	
134	Thyrister driver 1 H.P. with techogenerator	1 no	
135.	Voltage Stabilizer manual and automatic		1 no
each			

- Note:**
1. For each unit a trainee tool kit from Sl. No. 1 to 19 of "Tool Kit" and loker is required.
 2. If two units are working simultaneously in any shift, additional shop's General Outfits, items from Sl. No. 1 to 102 of "Shop Tools, Instruments & Machinery" is required for second unit.
 3. For each two units in a shift, one set of Machinery & Equipments from Sl. No. 103 to Sl. No. 135 are required.