SYLLABUS FOR

ELECTRICIAN

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

2007

General Information

1.	Name of the Trade	: Electrician
2.	N.C.O. Code No.	: 851.10, 851.30
3.	Duration of Craftsmen Training	: 2 years
4.	Duration of Apprenticeship Training	: 3 years including Basic Training of one year
5.	Entry Qualification	: Passed in 10th Class Examination Under 10 + 2 system of Education with Science as one of the subject or its equivalent
6.	Rebate of Ex-craftsmen Trainee	: Full (Electrician)
7.	Ratio of Apprentice of Workers	: 1 : 7

LIST OF MEMBERS OF TRADE COMMITTEE

1.	Shri S.I. Siddique Director of App. Training	D.G.E.T.–H. Qrs., New Delhi-1
2.	Shri H. Chatterjee, Director (HRD)	W.B.S.E.B. Calcutta
3.	Shri Soumen Basu, Principal	ITI-Tollygunge Calcutta
4.	Shri A.K. Das Trg. Officer	ATI-Calcutta
5.	D. Chakraborti E.R.O.	Bureau of Indian Standard, Calcutta
6.	S.K. Mitra Jt. Ch. Elect. Inspector	Directorate of Electricity Govt. of West Bengal
7.	T.K. Dey, W.I.	Kancharapara Tech. School, 24 pgs.
8.	K.N. Baske Principal	-do-
9.	Parimal Sarkar, Dy. Ch. Engineer	Kancharapara E. Rly. Workshop
10.	R.P. Bharthakur, Dy. Director	Directorate of Employment and Training, Assam
11.	B.K. Gangopadhyay, Ex-Engineer	C.P.W.D., Calcutta
12.	S.R. Majumdar, Director	CSTARI-Calcutta
13.	C.R. De, Jt. Director	-do-
14.	R.M. Sinha, Jt. Director	-do-
15.	P.N. Banerjee, J.D.T.	-do-
16.	J.K.R. Mukerjee, Dy. Director	-do-
17.	R.N. Halder, Dy. Director	-do-
18.	M.K. Parial, Asstt. Director	-do-
19.	J. Singh, Asstt. Director	-do-
20.	B.K. Chatterjee, Training Officer	-do-

Draft Syllabus for the Trade of Electrician Under C.T.S.

Duration—2 years

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculat & Science
1	2	3	4	5
1.	Familiarisation with Trade Instructor, Supervisor, Foreman, Principal.	Visit to the different sections of the Institute.		
	Activities, of the Institute, Importance of the Trade, Future Prospect etc. Duties and Responsibilities of Trainees, Safety measures to be observed.	Demonstration on elementary first aid. Artificial Respiration.		
	Elementary first Aid. Concept of Standard & standardization.			

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
2.	Matter, Atoms-Structure, Importance of Physics-Basic principles–work, Power, energy.	—	Freehand sketching of straight lines, rectangles, squares circle, polygons etc.	Electricity and its uses, Electric current positive. Use of switches & fuses. Conductors and insulators.
	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, chasis, clamps, rivets etc.		Applied workshop problems involving multiplication and division common fractions, add, subtract, multiplication and division. Application of friction to shop problems.
3. & 4.	Fundamental of electricity Electron theory-Solar system-elements, free electrons-Fundamental terms, definitions, units & effects of electric cur-	Practice in using steel rules, cutting pliers, screw drivers etc. skinning the cables, and joint practice on single strand.	Proportionate free hand sketching with dimensions	-do-

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
		Demonstration & Practice on bare conductors such as-Britania, straight, Tee, Western union.	Reading of simple blue prints	Properties and uses of copper, zinc, lead, tin, aluminium, brass, bronze, solder, bearing metals, timber rubber.
5.	Solders, flux and soldering technique. Resistors types of resistors & properties of resistors.	•Practice in soderings —Measurement of 'R' and Measurement of specific 'R'.	Conventional symbols of Electrical installation	
6.	Expl. definition and properties of conductors, insulators and semi-conductors.	Demonstration and identifications of types of cables	-do-	Properties & uses of cast iron, wrought iron, plain carbon steel, High speed steel and alloy steel.
	Types of wires & cables standard wire gauge	Demonstration & practice on standard wire gauge.		Decimals-add, Subtraction, multiplication, conversion of

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
	Classification of wires & Cables-Insulation & voltage grades –Low, medium & high voltage Precautions in using various types of cables	Safe use of cables and wires As per I.S. 732-1963-APP-D. Practice in crimping Thimbles, Lugs		decimals of to common fractions shop problems.
7. & 8.	Common Electrical Accessorie', their specifications, Common Insulating materials as per B.I.S. –Concept of ckts.–types of ckts as per property, as per current Flow	Demonstration and Practice on fixing common electrical accessories Building/Layout/assemble of small electrical ckts. with common electrical accessories-Reading & Ammeter Voltmeters	-do-	Brief description of manufacturing process of pig iron & cast iron. Reduction of common fractions to decimal fractions shop problems.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
	–Ohm's Law, series and parallel ckts. Kirchhoff's Law Reading of Analogy digital Ammeter and volt meters only use–of protective devices of ckts–Fuses & their types Earthing etc. –Simple problems on ckts. –Conception of developments of domestic ckts, Alarm & a switch, A lamp, A fan with individual switches etc./Two way switch	Verification & Ohm's Law -do- of series ckt. -do- of parallel ckt Practice in testing and connecting domestic appliances		

Achievements : The trainees should be able to make simple ckts with common electrical accessories with domestic electrical appliances for a specified voltage and current.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
9.	Chemical effect of electric current-Principle of electrolysis. Faraday's Law of electrolysis. Electro chemical equivalents. Explanation of Anodes and cathodes.	Assembly of a Dry cell-Electrodes–Electrolytes. –Grouping of Dry cells for a 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 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.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
11. & 12.	Lead Acid Cell general defects & remedies. Nickel Alkale 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 &	Symbols indicating the method of operation of the instrument and accessories IS : 1248-1968/APP. A. A-6	Brief description of manufacturing process of steel copper and aluminium

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
		maintenance of steel rule try-square and files.		
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 dimensions from samples.	Metric systems metric weights & measurements units-conversion factors.
15.	Practice in using taps & dies, threading hexagonal & square nuts etc. cutting external threads 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 firemer chis-	Description of carpenter's common hand tools such as	Free hand sketching of keys and screw threads with di-	Shop problems on metric system or weight and measure-

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
	el and preparing simple half lap joint.	saws planes, chisels mallet claw hammer, marking, dividing & holding tools–their care and maintenance.	mensions from samples.	ment.
17.	Practice in using snips, marking & cutting of straight & curved pieces in sheet metals. Bending the edges of sheets metals. Riveting practice in sheet metal. Practice in making 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 materials, fluxes and process.	Explanation of simple orthographic projection 3rd angle.	Mass-unit of mass force, absolute unit of force. The weight of a body unit of weight shop problems.

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.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5

2. Should be able to use simple carpenter's hand tools.
3. Should be able to use simple sheet metal workers hand tools.

18.	Define–magnetism & classification of magnets. Properties, care & maintenance, methods of magnetising magnetic materials. Para & Dia-magnets and Ferro magnetic substances.	Tracing the mg. field of a needle & Bar magnet. Practice in 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 electro-magnet and study the variation of field strength by vary-	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.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
	Magnetic terms Principle of electro-magnetic Induction, Faraday's Law, Lenz's Law.	ing current number of turns etc. Assembly/winding of a simple electro magnet.		
20.	Expl. types of resitsors 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 the 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.	-do-	Meaning of friction, Examples, Meaning of C.G. Examples. Specific gravity–Unit of work power & energy applied problems.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
		–Series & shunt ckts-use of Ohm meter.		
21.	Principle of D.C. generator. Fleming's right hand rules. Use of slip-ring & split rings. Use of commutator.	Expl./Demonstration on Fleming's rule	Sketching of brush and brush gear of D.C. machines. Lay out D.C. Panel board arrangement	Simple problems on straight and bell cranked levers.
22.	Explanation of D.C. Generators-function types-parts. E.M.F. equation-self excitation and separately excitated 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.	Calculations of Volume and weight of simple solid bodies-Cubes squares & hexagonal prisms and shop problems.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
23. & 24.	Types and characters of D.C. generators –Series Generators and types –Shunt Generators –Compound Generators & types –Their applications –Simple problems on generator types, capacity etc.	–Practice indismantling the D.C. generators. –Study of the parts of the D.G. Generators. –Voltage Building –Connection with panel Board. –Measurement of series. Shunt field resistances. –Identification of terminals of D.C. Generators. –Testing by megger.	Sketching of D.C. 3-point face Plate starter to scale.	Heat and temperature. Thermometric scales-centigrade. Fahrenheit scale and their conversion. Name and uses of temperature measuring instruments used in workshop.
25.	Define and expl. Armature reaction, interpoles and their uses, connection of interpoles, commutation. Electromagnetic Drag.	–Connection of shunt Generators; Measurement of voltages, No-Load & characters. –Demonstration on field ex-	Graphic symbols for Rotating m/cs and Transformers	Shop problems on determination of volume and weight of simple solid bodies.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
	Fleming's left hand rule. Principle of D.C. motor.	citation. –Load character of a series Gen. –Connection of a compound Generator-Voltage measurement-commulative and differential-Controlling and protecting equipment. No-Load & Load ch. of a compound Gen.		
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 & reversing.	-do-	-do-

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
27.	Types, characters and practical application of D.C. motors –Starting of D.C. motors –3 point & 4 point starters.	Study of the characters of D.C. motors. –Study of 3 point & 4 point starters. –Connection, starting, speed control of starters with motors.	-do-	-do-
28.	Types of 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.-4 point starter to scale.	-do-

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.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
29. & 30. & 31.	Expl. of electrical wirings, importance, I.E.E. rules. Types of wirings both domestic & industrial. –Specifications for wiring accessories–Wires cables, buttons etc. IS-732-1963/5 –Principle of laying out in domestic wiring-testing by meggar. C.T.S. system P.V.C. concealed system –Maintenance & Repairing data sheet preparation.	Fixing of switches, holder plugs etc. in T.W. boards. –Identification and use of wiring accessories. –Practice in C.T.S. wiring with minimum to more number of points. –Use of two way switches –Testing of Installation by meggar. –Fixing of calling bells/buzzers. –Making of test boards & extension boards IS-732-1963/61 –Repairing and testing of domestic electrical applia-	Free hand sketching of simple objects. Layout arrangement of D.C. Generators, control panel –Do for motors	Meaning of stress, strain, modules of elasticity, ultimate strength examples. Geometry-Properties of lines, angles, triangles and circles. Factor of safety examples, Types of stresses.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
32. & 33.	Specifications, 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, sp. bar, circular bar, tapered bar, staircase wiring.	Simple problems on lines, angles, tri-angles and circles.

Achievement : Should be able to carryout simple wiring ckts. undertake, repairs of domestic wirings and appliance.

34. & 35.	Comparison D.C. & A.C., Advantages of A.C. Alternating current & related terms-frequency, Instantaneous value, R.M.S. value Average value, Peak factor, Load fac-	Demonstration of sine wave, instantaneous values etc. Study of the behaviour of R, X_L & X_C 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.	Effect of force on materials such application as expanding bending, twisting and shearing. Trigonometry-functions use of trigonometric tables-Applied

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
	tor, form factor. Generation of sine wave, phase, in phase out phase. Obstructions of A.C.-'R' X_L & X_C. Impedence, power factor, Average power, Reactive power. Simple problems on A.C. obstructions & T.P. A.P. etc.		View of simple solid & hollow bodies. Drawing of sine waves.	problems. Mechanical advantages, velocity ratio, Applied problems.
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 and 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.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
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.	Exercises on Blue print reading of connection to motors through Ammeter, voltmeter & K.W. meters.	Useful work of a machine mechanical efficiency of a machine-problems. 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 Construction, parts working, E.M.F. equations efficiencies, parallel operation & poly phase types	Identification of types of transformers. Connection of transformers efficiencies of transformers testing of transformer parallel operation of transformer. Use of C.T. & P.T. use of Instrument transformer.	Exercises on Blue print reading, tracing the wiring diagram of a alternator & reproducing it in proper sequence with protective equipment sketching the synchroniser connections.	Logarithms-Use of Logarithmic tables for multiplication & division. Determination of efficiency of simple m/cs. like winch, pulley blocks, wheel and compound axle. Effects of electric current.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
	their connections. Cooling, protective devices. Specifications simple problems on e.m.f. equation, turns ratio and efficiency. Special transformers.		Free hand sketching of simple objects related to the trades.	
40.	Explanation of A.C. motors, comparison with D.C. classification-pulsating field & split pnasing. Working principle construction of 1-ph. motors Characters	Identification of Induction motors (1-ph) squirrel cage type –split phase type –capacitor type –slip ring type –starting of Induction motor. –Reversing –Dismantling Assembling	Diagram of connection to a squirrel cage induction motor. Sketching the connection diagram of controlling & protective devices for Induction motors.	Applied workshop problems involving, use of Logarithmic tables. Different forms of energy, heat mechanical and electrical, conversion from one to another.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
41. & 42.	Single phase motors contd. Split capacitors, repulsion and series motor working principle-parts-Characters starting-running & reversing. Stepper motor & Universal.	-do- Demonstration of Stepper & Universal Motor.	Development of winding diagram for a two pole D.C. dynamo or motor. Preparation of working drawing from sketches.	Plotting & reading of simple graphs.
43. 44. 45.	Explanation of Electrical measuring Instruments. –types –Forces necessary to work instruments –Moving coil permanent magnet –Moving iron –Range extension –Multimeter	Demonstration on scales on meters –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 simple objects related to trades. Sketching of different shapes of coils. Further practise in Blue print reading. Drawing development diagram for single phase A.C. motors.	Meaning of Horse Power & Brake horse power. Simple problems on work power & energy. Calculation of Volume, weight of simple solid bodies by using Logarithm. Further problems on mensuration.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
	–Wattmeter –Energy meter –Frequency meter –Calibration			
46.	Explanation of light	Study of intensity of lights.		Rectifier Maximum Average R.M.S. current in rectifiers form factor ripple factor.
47.	white lights-illumination fac-	-do- Neon Sign	Drawing the development diagram for D.C. Simplex Lamp & Wave winding	
48.	tors, intensity of light-impor-	-do- Mercury vapour (H.P. &		
	tance of light, human eye fac-	L.P.)		
	tor units-	-do- Sodium vapour		
	Types illumination & lamps	-do- Halogen Lamps		
	–Neon sign Halogen,	-do- Single tube,		
	Mercury vapour, sodium va-	Double tube		
	pour, Flourescent tube	Practice in Decoration light-		
	-Characters watt ages, fixing	ing.		
	places, Types of lighting.	-do- S.N. & R.N. Lamps		
	Decoration lighting-Drum			

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
	Switches, Direct & indirect lighting-efficiency in lumens per watt, colour available. Thumb rule calculations of lumens. Estimating placement of lights and fans and ratings. Explanation of S.N. and R.N. Lamps.			REVISION
49.	REVISION			
50.				
51.	T	E	S	T

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5

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. in conduct system on T.W. button as per IE rules.
4. Test & connect D.C. generators & motor & repair minor faults.
5. Connect, run and reverse A.C. motors.
6. Carryout 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 circuits for both 230 V & 440 V. 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. containing R., X & C.	Practice in the use of Logarithmic tables for multiplication, division square, root, cube root. Insulating material including transformer oil. -do- Natural
55. 56.	A.C. Winding terms, Armature winding terms, coil side,	Making foma, coil insulation, slot insulation, Insertion of	Further practice in Blue print reading, Drawing the	Insulating materials synthetic. Use of Log tables.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3		5
	end coil & grouping of coils. Connection to adjacent poles, connected armature winding, alternate pole connection, armature winding-Lap & wave connected.	coils in slots, coil connection-Practice, in single layer concentric winding.	development diagram for simple lap & wave winding -do-	Brief description & properties of electrical materials silicon, Nichrome 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-baking 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 windings, re-winding of detected faults in both D.C. & A.C.M/Cs.

59.	Revision of A.C. ckts. & obstructions & their behaviour	Expts. on A.C. ckts. 1 ph and poly phase.	Drawing the schematic diagram of automatic volt-	Brief description & properties of electric materials. Problems

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
	in series & in parallel ckts. Measurement of power and power factor & improvement of P.F. in 1-ph and in poly phases.	Expts. 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.	age regulators of A.C. generators. Drawing the schematic diagram of A.C. 3-ph reversing magnetic starter. Sketching a breather.	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 buchltz relay, other protective devices. Cooling of transformer. Transformer oil testing and top changing off load and on load. Transformer bushings and 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 parts & sectional views.	-do-

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
62. & 63.	Induction motor -Slip Squirrel Cage-Double Squirrel Cage Ind. motor & their Chs. Slip-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.	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 con-	Density of solids and liquids. Simple expts. on density. Simple problems involving Trigonometric function.

** Drawing the schematic diagram of Auto transformer starter.
-do- Push button starter. -do- Star Delta Starter

*** Trigonometric function. Use of trigonometric tables-supplied problems-Calculation of areas of triangles & polygons.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
	Repulsion motor-advantages principle-characters, Fault Location & Rectification.		nection of arrangement and push button control of two speed AC motor. IS : 3914-1967	
65.	Define-converter-inverter, M.G. Set-description-Characters, specifications-running & Maintenance.	Starting, running and building up voltage & loading of M.G. set. Maintenance of M.G. sets.	Drawing the schematic diagram of 4 typical D.C. speed regulators for shunt & compound motors. -do- Magnetic controller with dynamic breaking.	Specific gravity, Archimedes principle. Relation between Sp. gravity & density. Problems on trigonometry.
66. & 67.	Working of thermo-couple and its uses, KVAR & max. demand indicator. Ferrental type DC energy meter,	Study of thermo Couple instruments. -do- KVAR meter -do- Max. demand indicator.	Schematic diagram of magnetically rated. D.C. motor with three push button control station.	Qty. of heat, specific heat of solid, liquid and gases. Heat gained and heat lost. Simple problems on heat gained & heat

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
	Ampere-hour meter 3 plds. Energy meters Specifications maintenance & repair.	-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.	-do- Luminiscent Lamps	lost. Further problems on mensuration.
68. & 69.	Insulating materials, their classificationg, and their uses in industries.	Development of sequence of operation in detecting electrical & mechanical troubles in motors and Generators. Overhauling of A.C. and D.C. m/cs.	Sketching indicating instruments. Drawing the diagram of typical marking plate of a distribution transformer. Typical wiring diagram for drum & controller operation of A.C. wound rotor motor.	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.
70. to	Types, specifications, advantages of different types of cir-	Study of different ckt. breakers.	Layout diagram of a substation.	Examples a simple supported Load.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
74.	cuit breakers construction and maintenance. I.E.E. rules for over head service lines. Study of U.G. Cables and laying techniques. Working principle and construction of Domestic and agricultural appliances-their maintenance.	Study maintenance & repair of domestic & agricultural equipment- Electric kettle -do- heater/Immersion -do- hot plate -do- cooking range -do-Incubators -do- Furnaces etc. -Pump set.	Sketching different shapes of coils, sketches indicating possible faults in stator winding. Drawing the development diagram for dupler lap and wave winding with brush position.	General condition of equilibrium for series of forces on a body. Plotting of point. -do- graph simple Reading and plotting of simple graph.
75.	Wiring of light & fan ckts. on rolling stock Installation Lighting arrestor/lighting conductor	Practice of wiring of lights and fans on rolling stock. Practice of fixing lightening arrestors and lightening conductors.	-do-	Centre of gravity simple expts. for determination, reading and plotting of graphs. Stable, unstable and neutral equilibrium bodies.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
				Friction limitation Laws of friction, co-efficient of friction, angle of friction.

Achievement : Should be able to repair lighting ckts, Horn ckts. etc.

76.	Study of the arc controlling devices. Explanation and classification & uses of miniature relays & protector devices. Use of electro-magnetic clutches. Explanation and principle of operation	Study of miniature relays. -do- Electro-mag. clutches. -do- Mercury Arc 1 ph/Poly phase rectifier -do- Metal rectifier.	Single line diagram of sub-station feeders Connection diagram of typical overload current relays. Key diagram of a power station. Central controlling panel.	Simple estimation of the requirement of materials etc. as applicable to the trade. Mechanical advantages velocity ratio, efficiency of simple pulley wheel screw jack and winch.

Achievement : Should be able to install a rectifier and repair the same for minor faults.

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
77.	Introduction to electronics-conductor-Insulator-semi conductor 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-symbol 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. 79. & 80.	Expl. and importance of D.C.-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.	Study of Half wave rectifier ckt. -do- Full " " -do-Bridge " " -do- Filter ckts -do- Oscilloscope -do- Different wave shapes and their values	Filling of m/cs history card & maintenance cards and Inventory control card.	Problems as estimation

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
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 transistors.	Drawing of B.I.S./I.S.I. symbols for Electronic devices, Drawing of half wave, Full wave & Bridge ckts.	-do-
83. to 84.	Expl. & Definition of 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 Multi stage Amplifiers and types of signals.	-do-
85. to	Expl, and definition of oscillator-working principle Ex-	Study of oscillator ckt. Voltage measurement-current	-do-	-do-

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
86.	planation of stages and types.	-do- And study wave shapes in scope.		
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- FET as an amplifier -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. & 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. &	Complete House wiring Layout. Circuit spliting load wire.	Practice in wiring and in maintenance of institute & Hostel	Drawing of simple Lap and wave winding.	-do-

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
94.	I.E.E. rules. Multistorie house wiring system. Fault finding & repair. Repairing of domestic electrical appliances.	building. Layout & repairing of workshop electrical installation.		
95. to 97.	Fault finding techniques in Decoration lighting. -do- Commercial displays -do- Dynamo, Generators etc.	Fault finding practice	-do-	-do-
98.		INDUSTRIAL VISIT & STUDY TOUR		
99. to 100.		Fault finding in simple electronic ckts. & controls attached in the electrical controls.		

Week No.	Trade Theory	Trade Practical	Engineering Drawing	Workshop Calculation & Science
1	2	3	4	5
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. Traceout 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.
8. 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 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, accuracy and finish in jobs which would normally consist of operations/skills already learnt by him earlier.

Sl. No.	List of operations/skills to be learnt during apprenticeship.
1st Year	
1.	Instructions 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*) Planing
   (*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 joints 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, condensor etc.
26.* Use of wire gauge, techometer.
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, field 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.* Repairs 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 convertor 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 the 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

I. 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 type 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 stage 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 problems 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. Descriptive 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 stresses.
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 : (IS : 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 (IS : 732-1953).
7. Drawing of sectional views of armatures, cores, switches, bearings, 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 × 4 mm (Knurled centre position)	16
3.	Pincer 150 mm	16
4.	Plier insulated 150 mm	16
5.	Screw driver 150 mm	16
6.	Punch centre 150 mm × 9 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 Ineon Tester	16
11.	Heavy duty screw driver 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	
17.	Gimlet 6 mm	16
18.	Bradawl	16
19.	Plier sude cutting 150 mm	16
	Shop Tools, Instruments & Machinery	
1.	C. Clamps 200 mm, 150 mm, 100 mm	2
2.	Spanner 150 mm adjustable 15 degree as cly-burns	2
3.	Blow lamp 0.5 litre	2
4.	Melting pot	1
5.	Ladder	2
6.	Chisel cold flat 12 mm × 200 mm	2
7.	Chisel wood firmer 25 mm and 6 mm	4

Sl. No.	Items	Quantity
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	1 set
12.	Oil can 0.12 litre	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.	Pullypuller	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 amp. D.C.	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 2.5 kg.	2 set
28.	Stop watch	1
29.	Techno-meter or revolution counter with stop watch	1
30.	Scissors blade 150 mm	4
31.	Crimping tool	1 set
32.	Screw driver 100 mm	4
33.	Chilsel 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 blade	4
38.	Divider 150 mm, outside & inside calliper	3 (each)
39.	Plier flat nose 100 mm	4
40.	Plier Gas round nose 100 mm	4
41.	Plier Gas 150 mm	4
42.	Tweezer 100 mm	4
43.	Snip straight 150 mm	2

Sl. No.	Items	Quantity
44.	Snip bent 150 mm	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, 5 mm, 6 mm set of 3	4
48.	Plane, smoothing cutters, 50 mm	4
49.	Gauge, wire imperial	2
50.	File flat 200 mm 2nd cut	3
51.	File half round 200 mm 2nd cut	4
52.	File half round 200 mm smooth	4
53.	File round 200 mm 2nd cut	4
54.	File round 100 mm 2nd cut	4
55.	File flat 150 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.	1
64.	Ammeter M.C. 0-5 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. 0-5 A	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.	Vice, table jaw 100 mm	3
77.	Lockers with 3 drawers (Standard size)	2
78.	Bench working 2.5 × 1.20 × 0.75 meters	4
79.	Almirah 2.5 × 1.20 × 0.50 meter	1

Sl. No.	Items	Quantity
80.	Instructor's table	1
81.	Instructor's chair	2
82.	Fire extinguisher	2
83.	Fire buckets	4
84.	Metal rack 180 × 150 × 45 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, 1000 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 litre 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 upto 5 cm dia	4
95.	Pipe cutter to cut pipes upto 5 cm dia	1
96.	Cut out, reverse current, over load voltage relays	1 each
97.	Stock and die set for 20 mm to 50 mm G.I. pipe	
98.	Starters for 3-phase, 400 V, 50 cycles, 2 to 5 H.P. A.C. motors	
	(*a*) Auto transformer type starter	1
	(*b*) Star delta starter with manual, Semi-auto & Automatic	1
	(*c*) Direct on line starter	1
99.	Motor A.C. series type 230 V, 50 cycles, 1/4 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 phase). 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.
102.	Multi meter	2 Nos. (large size)
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 5 HP, 440 Volts with starting compensator and switch directly coupled to generator AC. 3.5 KVA, 400/230 volts, 3-phase, 4 wire, 0.3 PF 50 cycles with exciter and 1 switch board mounted with regulator, circuit breaker, ammeter, voltmeter frequency meter, knife blade switch and fuses etc. Set complete with cast iron bed plate, fixing bolts, foundation bolts, & flexible coupling.	1
105.	Motor series DC, 220 volt, 0.5 to 2 HP, 0.5 to 2 HP.	1
106.	Motor shunt DC 220 volt, 2 to 3 HP.	2
107.	Motor of AC squirrel cage, 3-phase, 400 volt, 50 cycles, 2 to 3 HP with star delta starter & triple pole iron clad switch fuse.	1
108.	Motor AC phase-wound slip ring type 5 HP 400 volts, 3-phase, 50 cycles with starter and 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 and switch.	1
111.	Motor AC single phase 230 volt, 50 cycles sereis type with starter/switch1 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, 3 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.	D.C. shunt generator, 2.5 KW, 220 V with control panel	1
120.	D.C. 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, 5 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. 5 KVA	1 no.
134.	Thyrister drive 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 locker is required.

2. If two units are working simultaneously in any shift, additional shop's General Outfit, item 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 & Equipment from Sl. No. 103 to Sl. No. 135 are required.