

SYLLABUS FOR THE TRADES
OF
ELECTRICIAN & WIREMAN

UNDER
CRAFT INSTRUCTOR TRAINING SCHEME (CITS)
Two Semesters (One Year)

Redesigned in - 2014

By
Government of India
Ministry of Labour & Employment (DGET)

Course structure

The Course contains two semesters each of six month duration

Semester-I	Semester-II
Trade Technology- I	Trade Technology-II
Workshop Calculation & Science	Training Methodology
Engineering Drawing	
Degree/ Diploma holders in Electrical/ Electrical & Electronics Engineering can directly appear in first semester exam.	

GENERAL INFORMATION FOR TT1

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|--------------------------------------|--|
| 1. Name of the Scheme | : Craft Instructors' Training Scheme |
| 2. Name of the Trade | : ELECTRICIAN & WIREMAN |
| 3. N.C.O.Code | : |
| 4. Duration of Training | : 1 Semester (06 months) |
| 5. Power norms | : Workshop - 5.2 kW;
Class Room - 1 Kw |
| 6. Space norms | : Workshop - 140 Sq.Mt.
Class room - 30 Sq. Mt.
(@ 1.5 Sq. Mt. Per trainee) |
| 7. Entry Qualification | : NTC/NAC passed in Electrician/Wireman or
Diploma/Degree in Electrical / Electrical &
Electronics Engineering |
| 8. Unit size (No. Of student) | : 20 Trainees |
| 9. Trainer's Qualification | : Degree in Electrical / Electrical & Electronics
Engg from AICTE approved institute with
two years experience in the relevant field

OR

Three years Diploma in Electrical/ Electrical
& Electronics Engineering from AICTE
approved institute with five years'
experience in the relevant field |

Note:-

(i) Degree/ Diploma holders in Electrical/ Electrical & Electronics Engineering can directly appear in first semester exam.

(ii) In case of two units, one trainer must have Degree in Engineering.

Syllabus for the Trade of “Electrician & Wireman”

Duration : Six Months

First Semester: TT - I

Week No.	Trade Practical	Trade Theory
1	Safety Practices <ul style="list-style-type: none"> • Fires in electrical Circuits & Precautions • Fire Extinguishers & its Types • General Safety of Tools & Equipment • Rescue of person who is in contact with live wire • Treat a person for electric shock/ injury 	<ul style="list-style-type: none"> • Fire Fighting • Safely handling Tools & Equipment • Use of proper Tools & Equipment & its maintenance • Rescue of person who is in contact with live wire • Treat a person for electric shock/ injury
2	Basic Electricity <ul style="list-style-type: none"> • Verification of Ohm’s Law. • Measure current & voltage in series and parallel circuits. • Measurement of Resistance using Wheat- stone bridge. • Verification of Kirchhoff’s Laws. • Practice on bare conductor joint. • Practice on PVC wire joints. • Practice on Crimping of lugs. • Soldering Practice. 	<ul style="list-style-type: none"> • Fundamentals, Ohm’s Law, • Kirchhoff’s Laws, Series & Parallel combination of Resistors, Inductors & Capacitors. • Laws of Resistance • Wheatstone bridge • PVC wires, Conductors & cables. • Wire joints, Soldering.
3 - 4	Effects of Electric current <ul style="list-style-type: none"> • Connecting heating elements & solenoid coil. • Preparation of electrolyte. Measurement of specific gravity. Grouping of Cells. • Testing the battery with High rate discharge tester& Hydrometer. • Different methods of battery charging. • Care & Maintenance. 	<ul style="list-style-type: none"> • Heating, lighting, magnetic & chemical effect of electric current. • Joule’s law. • Electrolysis & its laws • Cells and Batteries- Primary & secondary cells, their construction & working. • Lead Acid battery in detail- Hybrid cell, Alkaline cell, Charging Methods. • Care & Maintenance of Battery.

5 - 6	Wiring systems and types – <ul style="list-style-type: none"> • Practice in using Wire gauge and Micrometer. • PVC, Casing -capping, Conduit wiring, Testing, Maintenance and repairing of wiring. • Application of fuse, MCB, ELCB relays. • Multi-storied building wiring. • Measuring Earth resistance by Earth tester. 	<ul style="list-style-type: none"> • National Electrical Code, SWG, common electrical Accessories – MCB, ELCB, MCCB, RCCB etc. • Comparison between different types of wirings. • Installation, Testing methods – Wiring estimations & cost. • Earthing, types, methods, improving earth resistance, Earth tester.
7-8	Magnetism, Alternating current & Poly phase system <ul style="list-style-type: none"> • Preparation of electromagnet. • Testing of Capacitor. • Measurement of R, L, C, Z, Power, Power Factor, Energy by different methods – Single Phase & 3 Phase. • Measure the line & phase values of voltage & current in star & Delta connection. 	<ul style="list-style-type: none"> • Terminology used in magnetic circuit • Permanent Magnet • Principle of electro magnet • Capacitor & its types. • Faraday’s laws of Electromagnetic Induction. • Fleming’s rule, B-H Curve. • Fundamental terms. • Solving RLC circuit –series & parallel resonance. • Star & Delta connections. • Three phase three wires & three phase four wires system. • Three phase Power.
9-10	DC Generator <ul style="list-style-type: none"> • Identification of parts of DC generator • Build up the voltage on Shunt Generator. • Connection of Compound Generator & Build up voltage • Characteristics of series Shunt and Compound generator • Dismantling & reassembling of DC Generator. 	<ul style="list-style-type: none"> • Construction& Principle. • Types-Series, Shunt & Compound Generator. • EMF equation, Characteristics (OCC & LCC). • Armature reactions, commutation • Efficiency, Regulation& Applications. • Parallel operations • Care and maintenance & Trouble shooting.
11-12	DC Motor <ul style="list-style-type: none"> • Identification of parts of DC motor. • Starting and running of series, shunt & compound Motors using 	<ul style="list-style-type: none"> • Construction& Principle. • Types- Series, Shunt & Compound Motors. • Characteristics curve.

	<p>starter(3 point& 4 point).</p> <ul style="list-style-type: none"> • Speed control of DC Shunt motor (armature & Field control. • Characteristics curve &Efficiency • Dismantling & Re assembling of DC motor. 	<ul style="list-style-type: none"> • Applications. • Necessity of starter • Construction and Working of starters (3 point& 4 point). • Speed control of DC Shunt motor (armature & Field control. • Traction System. • Trouble shooting –Care and maintenance
13	<p>Work, Power & Energy, Power factor</p> <ul style="list-style-type: none"> • Measure the power & Power Factor in a balanced & unbalanced load by two wattmeter method, use of Power Factor meter. • Improve the power factor of a circuit using static capacitor. • Measure Energy in single phase Load. 	<ul style="list-style-type: none"> • Active& Reactive Power. • Simple calculation for Work, Power & Energy. • Definition, significance • Causes & effects of low power factor. • Methods of Improving power factor. • Calculation of capacitor banks. • Automatic power factor correction (APFC) Panels.
14-15	<p>Transformer</p> <ul style="list-style-type: none"> • Transformation ratio. • Open Circuit (OC) Test ,Short Circuit(SC) test ,Efficiency &Regulation • Parallel Operation. • Connection of star and Delta • Testing of Oil • Troubleshooting. • Verify the voltage of autotransformer with different tapings. • Measurement of high current & voltage using CT and PT. 	<ul style="list-style-type: none"> • Principle, Construction. • Classification of Transformers • EMF equation ,rating • Loading, Losses & Efficiency Regulation. • Parallel Operation • Cooling methods, Transformer oil testing. • Care and maintenance, Protective devices. • Tap Changer –ON load and OFF load. • Auto transformer, Instrument Transformer- CT & PT. • Welding Transformer.
16-17	<p>Electrical Measuring instruments</p> <ul style="list-style-type: none"> • Identify the types of instruments • Uses of PMMC and MI meters • Calibration of meters. • Calibration of Energy meter. • Measurement of insulation resistance. 	<ul style="list-style-type: none"> • Types -PMMC,MI Meters. • Principle and construction. • Digital meters. • Megger & Earth tester. • Calibrations of meters.

18	Illumination <ul style="list-style-type: none"> • Connection & Installation of all kinds of lamps. • Connection of single & twin tube light fittings. • Connection of HPMV & HPSV lamp. • Practice on Decorative Light. • Use of Lux- meter. 	<ul style="list-style-type: none"> • Laws of Illumination. • Terminology used in Illumination. • Types of Lamps-Incandescent Lamp and Discharge Lamp- fluorescent, HPMV, HPSV Lamps. • Drum Switch, Lighting calculations. • Energy efficient lighting systems (CFL, LED etc.)
19-20	Basic Electronics <ul style="list-style-type: none"> • Colour coding of Resistors. • Construction of Rectifiers. • Check the different wave shape using CRO. • Testing the Transistor • Single stage Amplifier • Simple circuit containing power diode & power transistor. • UJT for Triggering, FET & MOSFET as an amplifier. • Control circuit for -SCR, DIAC, TRIAC, IGBT. 	<ul style="list-style-type: none"> • Semi-conductor diodes , Characteristics • Zener diode • Rectifiers & filter circuits. • Working principle and use of CRO. • Transistor, Amplifier & types. • Introduction to Oscillator. • Basic concept of Power diode, power transistor, • Introduction to- UJT, FET, SCR, DIAC, TRIAC, MOSFET, IGBT.
21	<ul style="list-style-type: none"> • Assemble different OP-AMP circuits using IC 741. • Verification of Logic gates truth tables. 	<ul style="list-style-type: none"> • Introduction to Operational Amplifiers(IC-741). • Digital Electronics –Number System, Logic gates
22-23	INDUSTRIAL VISIT AND RELATED PROJECT WORK. Suggested visit to – Power Generating Plants / Substations/Electric Traction/Manufacturing units of Electrical Machines/Transformer etc.	
24 - 25	NCVT EXAM	
26	SEMESTER GAP	

**LIST OF TOOLS & EQUIPMENTS
CRAFTS INSTRUCTOR TRAINING SCHEME**

Should be available separately in Workshop for (TT-1)

FOR BATCH OF 20 TRAINEES		
TOOL KIT		
Sl. No.	Name of the items	Quantity
1	Steel Tape, 10 mtr length	20 Nos.
2	Plier Insulated, 150 mm	20Nos.
3	Plier Side Cutting, 150 mm	20 Nos.
4	Screw Driver, 100 mm	20 Nos.
5	Screw Driver, 150 mm	20 Nos.
6	Electrician Connector, screw driver insulated handle thin stem, 100 mm	20 Nos.
7	Heavy Duty Screw Driver , 200 mm	20 Nos.
8	Electrician Screw Driver thin stem insulated handle, 250 mm	20 Nos.
9	Punch Centre , 150 mm X 9 mm	20 Nos.
10	Knife Double Bladed Electrician	20 Nos.
11	Neon Tester	20 Nos.
12	Steel Rule 300 mm	20 Nos.
13	Hammer, cross peen with handle	20 Nos.
14	Hammer, ball peen With handle	20 Nos.
15	Gimlet 6 mm.	20 Nos.
16	Bradawl	20 Nos.
17	Scriber (Knurled centre position)	20 Nos.
18	Pincer 150 mm	20 Nos.
19	Wire Stripper	20 Nos
20	Tennon Saw 250 mm	20 Nos
21	Firmer chisel wood 12mm	20 Nos

B. SHOP TOOLS, INSTRUMENTS & MACHINERY

Should be available separately in Workshop for (TT-1)

Sr. No.	Name of the items	Quantity
1	C- Clamp 200 mm, 150 mm and 100 mm	2 Nos each
2	Spanner Adjustable 150 mm, 15 degree	2 Nos
3	Blow lamp 0.5 ltr	2Nos
4	Melting Pot	1No
5	Ladel	2Nos
6	Chisel Cold firmer 25 mm X 200 mm	2 Nos
7	Chisel 25 mm & 6 mm	4 Nos each
8	Hand Drill Machine 0 to 6 mm capacity	1No
9	Portable Electric Drill Machine 6 mm capacity	1No
10	Pillar Electric Drill Machine 12 mm capacity	1No
11	Allen Key	1 set
12	Oil Can 0.12 ltr	2 Nos
13	Grease Gun	1 No
14	Out Side Micrometer 0 to 25 mm	1No
15	Motorised Bench Grinder	1No
16	Rawl plug tool & bit	2 set
17	Pully Puller 3 legs 250 mm adjustable	2Nos
18	Bearing Puller 3 legs 120 mm flexible	2Nos
19	Hydrometer	2 set
20	Thermometer 0 to 100 deg Centigrade	1 No
21	Scissors blade 150 mm	4 Nos
22	Crimping Tool	1 set
23	Crimping Tools Heavy duty	2 Nos
24	Chisel Cold flat 12 mm	2 No
25	Mallet hard wood 0.50 kg	4 No
26	Hammer Exeter type 0.40 kg	8 nos
27	Hacksaw frame 200 mm 300 mm adjustable	4 Nos
28	Try Square 150 mm blade	4 Nos
29	Outside & Inside Divider Calliper	2 Nos each
30	Pliers flat nose 100 mm	4 Nos
31	Pliers round nose 100 mm	4 Nos
32	Plier longnose 150 mm	4 Nos
33	Tweezers 100 mm	4Nos
34	Snip Straight & Bent 150 mm	2 Nos each
35	Spanner D.E. metric standard	4 Nos
36	Drill hand brace 0 to 100 mm	4 Nos
37	Drill S.S. Twist block 2 mm, 5 mm 6 mm set of 3	4 set
38	Plane, smoothing cutters 50 mm	4 Nos.
39	Gauge, wire imperial (SWG)	4 Nos
40	File flat 200 mm 2 nd cut	8 Nos.
41	File half round 200 mm 2 nd cut	4 Nos
42	File round 200 mm 2 nd cut	4 Nos.
43	File flat 150 mm rough	4 Nos.
44	File flat 250 mm bastard	4 Nos.

45	File flat 250 mm smooth	4 Nos.
46	File Rasp, half round 200 mm bastard	4 Nos.
47	Soldering Iron 25 watt, 65 watt, 125 watt	4 Nos each
48	Copper bit soldering iron 0.25 kg.	4 Nos.
49	De soldering Gun	4 Nos
50	Hand Vice 50 mm jaw	4 Nos
51	Table Vice 100 mm jaw	8 Nos.
52	Pipe Cutter to cut pipes upto 5 cm. dia	2 Nos.
53	Pipe Cutter to cut pipes above 5 cm dia	1 No.
54	Stock and Die set for 20 mm to 50 mm G.I. pipe	1 No.
55	Ohm Meter; Series Type & Shunt Type	1 No. each
56	Stock and Dies conduit	4 Nos
57	Multi Meter (analog) 0 to 1000 M Ohms, 2.5 to 500 V	1 No
58	Digital Multi Meter 3 ½ digit	8 Nos
59	A.C. Voltmeter M.I. 0 –500V A.C	1 No
60	Milli Voltmeter	6 Nos
61	D.C. Milliammeter 0 -500m A (Digital+ Analog)	1 No.
62	Ammeter MC 0-1A, 0-5 A, 0- 25 A	1 No.
63	A.C. Ammeter	2 Nos each
64	A.C. Ammeter M.I 0-10 -20 A, 0-15-25 A	2 Nos each
65	Kilo Wattmeter 0-5 kw (CC-0-5-10 A,PC-0-250-500V)	2 Nos
66	A.C. Energy Meter,Single phase 5 amp. Three Phase 15 amp	2 Nos
67	Power Factor Meter single phse-230 volt (Analog+ Digital)	1 No each
68	Frequency Meter (Analog+Digital)	1 No each
69	Tachometer with stop watch (Analog + Digital)	1 No each
70	Current Transformer Primary-0-10-20 A, Sec- 5 A)	2 Nos
71	Potential Transformer(0-230-400V/110V)	2 Nos
72	Growler Internal+ External	1 No each
73	Tong Tester / Clamp Meter 0 – 100 amp. AC Analog+ Digital)	1No
74	Megger 500 volts	1No
75	Wheat Stone Bridge with galvanometer & battery	1No
76	Earth Tester 0-30 Ohm	2 No
77	Contacto r & auxiliary contacts 3 phase, 440 volt, 32 amp.	1 No each
78	Load Bank5 KW(Lamp / heater Type)	1No
79	Brake Test arrangement with two spring balance 0 to 25 kg rating	2 set
80	DC Power Supply 0-440v , 15A	2 No
81	Inverter- 1 KVA with 12 V Battery Input- 12 volt DC, Output- 220 volt AC	1No
82	Voltage Stabiliser Input: 150 – 230 volt AC Output: 220 volt AC , 1 KVA	1 No
83	Rheostat 0 -1 Ohm, 5 Amp 0 -10 Ohm, 5 Amp 0- 25 Ohm, 10 Amp 0- 300 Ohm, 3 Amp	2 Nos. each
84	Flux meter	2 Nos
85	Laboratory Type Induction Coil	1 no

EQUIPMENTS & MACHINERY for TT-1		
Sl. No.	Name of the items	Quantity
1	Used DC Generators-series, shunt and compound type for overhauling practice	
2	3- point D.C. Starter	2 Nos
3	4- point D.C. Starter	2 Nos
4	D.C. Shunt Generator with control panel, 2.5 KW, 230 V	1No
5	D.C. Compound Generator with control panel including fitted rheostat, voltmeter, ammeter and breaker,2.5 KW, 230 V	1No
6	DC Series Motor coupled with mechanical load 0.5 to 2 HP, 220 Volts	1No
7	DC Shunt Motor 2 to 3 HP, 220 volts	1No
8	DC compound Motor with starter and switch 2 to 3 HP, 220 volts	1No
9	Single phase Transformer, core type, air cooled	3Nos
10	Three phase transformer, shell type oil cooled	1No
11	Variable Auto Transformer	1No
12	Oscilloscope Dual Trace,30 MHZ	1No
13	Function Generator	1No
14	Discrete Component Trainer	1No
15	Linear I.C.Trainer	1No
16	Digital I.C.Trainer	1 No
17	Bath Impregnating	1 No
18	Oven Stove	1 No
19	Oil Testing Kit	1 No
20	Battery Charger	1 No
21	Hygrometer	1 No

NOTE:- Electrical Machine Trainer & Motor-Generator (AC to DC) may be used from TT - 2.

FURNITURES in workshop for TT 1

Sl. No.	Name of the items	Quantity
1	Instructor's table	1 No
2	Instructor's chair	2 Nos
3	Metal Rack 100cm x 150cm x 45cm	4 Nos
4	Working Bench 2.5 m x 1.20 m x 0.75 m	4 Nos
5	Lockers with 2 drawers standard size	2 Nos
6	Almirah 2.5 m x 1.20 m x 0.5 m	1 No
7	Black board/white board	1 No
8	Fire Extinguisher	2 Nos
9	Fire Buckets	4 Nos

NOTE :1. No additional item except those under trainees tool kit are requires to be provided for a second batch.

GENERAL INFORMATION FOR TT2

1. **Name of the Scheme** : Craft Instructors' Training Scheme
2. **Name of the Trade** : ELECTRICIAN & WIREMAN
3. **N.C.O.Code** :
4. **Duration of Training** : 1 Semester (06 months)
5. **Power norms** : Workshop - 5.2 kW;
Class Room - 1 Kw
6. **Space norms** : Workshop - 140 Sq.Mt.
Class room - 30 Sq. Mt.
(@ 1.5 Sq. Mt. Per trainee)
7. **Entry Qualification** : NTC/NAC passed in Electrician/Wireman or
Diploma/Degree in Electrical / Electrical &
Electronics Engineering
8. **Unit size (No. Of student)** : 20 Trainees
9. **Trainer's Qualification** : Degree in Electrical / Electrical &
Electronics Engg. from AICTE approved
institute with two years' experience in the
relevant field

OR

Three years Diploma in Electrical/ Electrical
& Electronics Engineering from AICTE
approved institute with five years'
experience in the relevant field

Note:-

(i) Degree/ Diploma holders in Electrical/ Electrical & Electronics Engineering can directly appear in first semester exam.

(ii) In case of two units, one trainer must have Degree in Engineering.

Syllabus for the Trade of “Electrician & Wireman”

Duration : Six Months

Second Semester: TT-II

Week No.	Trade practical	Trade Theory
1 - 2	Three phase Induction motor <ul style="list-style-type: none"> • Connection with various starters. • Starting, running & loading of ac 3 phase Squirrel cage & Wound rotor Induction motors. • Change the direction of rotation. • Measurement of speed, torque, slip, current, power , PF etc. 	<ul style="list-style-type: none"> • Squirrel Cage & Wound Rotor:- Construction , parts , working principle • Concept of rotating magnetic field • Applications. • Types of starters-DOL, Star delta, Auto transformer starter etc. • Rotor resistance type starter. • Introduction to Speed control of 3 phase Induction motor. • Torque-speed characteristics. Losses & efficiency.
3	Single phase & Special type of motors <ul style="list-style-type: none"> • Starting, running of single phase motors & change DOR [direction of rotation]. • Dismantling and Reassembling of different types of 1 Ø motors. 	<ul style="list-style-type: none"> • Classification, Construction, Working Principle & uses. • Methods of starting. • Stepper motor, servo motor etc.
4 - 5	Alternator <ul style="list-style-type: none"> • Identification of parts and terminals of Alternator. • Build up voltage, Excitation, loading, Characteristics. • Calculation of Regulation & Efficiency. • Synchronisation (Parallel Operation) of Alternators by Different Methods. • Starting and Running, building up voltage and loading of MG set. 	<ul style="list-style-type: none"> • Types- Hydro & Turbo • Construction, Working Principle. • Excitation methods, EMF Equation, Phase sequence, loading and characteristics. • Efficiency & Voltage regulation. • Parallel operations, conditions for Synchronisation. • Brushless alternator. • AVR (Automatic voltage regulator). • MG set –Description, specifications & Characteristics.
6	Synchronous Motor <ul style="list-style-type: none"> • Identification of parts of Synchronous Motor. • Connect, Start and Run the Synchronous Motor. • Plot V curve • Application of synchronous motor. • Power factor correction 	<ul style="list-style-type: none"> • Construction, Working Principle, Starting Method. • Effect of change of excitation on load. • V-curve and Inverted V -curve. • Power factor correction.

7 - 8	Winding and Insulating materials <ul style="list-style-type: none"> Practice on small transformer winding. Testing of burnt out DC machine for re- winding, winding procedure, practice on small armature winding, impregnation, baking. 	<ul style="list-style-type: none"> Small transformer winding technique DC machine winding, various types and methods, development diagram, winding procedure.
9 - 10	<ul style="list-style-type: none"> AC motor stator Re- winding:- Testing of burnt stator, rewinding procedure, practice on single & double layer winding. Impregnations, Varnishing, Baking & Assembling. 	<ul style="list-style-type: none"> AC Motor stator Re-winding- Single phase & Three phase winding development diagram. Winding procedure.
11-12	Basic Rectifiers and Inverter circuits- <ul style="list-style-type: none"> Basic Rectifiers and Inverter ckt. Speed control of DC Motor using DC Drive. Speed control of AC Motor (Induction Motor) using AC Drive. Maintenance of AC/DC machines, voltage stabiliser, UPS, Inverter & Drives. 	<ul style="list-style-type: none"> Working principle, Construction, parameterization, Speed control. DC drive. AC drive. Preventive& Break down Maintenance of DC / AC machines, Voltage stabilizer, UPS, Inverter.
13-14	Industrial Wiring <ul style="list-style-type: none"> Practice on wiring of motors. Protective devices and control panel etc. Practice of wiring on UPS & Inverter. Practice on control cabinet/ control panel assembly, wiring, checking/buzzing & testing for the following exercises on 3 \emptyset induction motor. <ul style="list-style-type: none"> DOL starter with push button control. Forward / Reverse starter Automatic Star/Delta starter. 	<ul style="list-style-type: none"> Wiring of Electrical Motor and Control Panel. Machine control cabinet /control panel layout ,assembly & wiring – Power & control circuits, control elements- Push button switches, contactor, overload Relay etc.
15-16	Domestic appliances <ul style="list-style-type: none"> Repair and test of various domestic appliances and equipment. Dismantling, Servicing, re-assembling & Testing. Care & Maintenance. 	<ul style="list-style-type: none"> Working principle and circuits of common domestic equipment and appliances:-Heaters, geysers, electric iron, domestic Mixer, Hair drier, UPS Inverter, Microwave Oven, Induction Heater, Washing Machine etc. Concept of neutral and earth.

17	Planning, Estimation & Costing Of Wiring <ul style="list-style-type: none"> • Domestic • Industrial • Commercial and • Multi-storeyed building • Workshop • Estimating and costing labour/ Materials-accessories as per layout. 	<ul style="list-style-type: none"> • Concept-Principle of plan-estimation and cost-preparation of wiring layout :- domestic/Industrial/Commercial. • I.E rules for multi-storeyed building.
18-19	Power Generation <ul style="list-style-type: none"> • To visit and Prepare layout plan/ single line diagram of the Thermal /Hydro /Nuclear power plant. • Non-conventional power plant – Prepare layout plan. 	<ul style="list-style-type: none"> • Block diagram of Hydro, Thermal & Nuclear Power plants. • Non-conventional energy :- Introduction ,various types of non-conventional energy resources –Wind, Solar, Small Hydro and Bio-mass.
20-21	Transmission of electric power, UG cables & Distribution of power :- <ul style="list-style-type: none"> • Identification of different types of insulators • Binding insulators, fixing of jumper by crimping tool. • Joints in UG cables. • Visit to HT/LT Substation 	<ul style="list-style-type: none"> • Single Line Diagram of Substations. • Electric supply system- comparison of EHVAC and HVDC transmission. • Advantages of high voltage transmission • Overhead lines: - Poles& Towers, bushings, Insulators & its types. • Corona effect, Bundle-conductors, Sag, Skin effect& Ferranti effect. Fault studies. • Construction, material, insulation, classification. • 3 phase service-cable fault. • Sub- Station HT/LT –Function, equipment, types of distribution system accessories-protective relays, circuit breakers-lightning arrestor used in HT line .
22-23	INDUSTRIAL VISIT AND RELATED PROJECT WORK. Suggested visit to – Power Generating Plants / Substations/Electric Traction/Manufacturing units of Electrical Machines/Transformer.	
24-25	NCVT EXAMINATIONS	
26	SEMESTER GAP	

**LIST OF TOOLS & EQUIPMENTS
CRAFTS INSTRUCTOR TRAINING SCHEME**

Should be available separately in Workshop for (TT-2)

FOR BATCH OF 20 TRAINEES		
TOOL KIT		
Sl. No.	Name of the items	Quantity
1	Steel Tape, 10 mtr length	20 Nos.
2	Plier Insulated, 150 mm	20Nos.
3	Plier Side Cutting, 150 mm	20 Nos.
4	Screw Driver, 100 mm	20 Nos.
5	Screw Driver, 150 mm	20 Nos.
6	Electrician Connector, screw driver insulated handle thin stem, 100 mm	20 Nos.
7	Heavy Duty Screw Driver , 200 mm	20 Nos.
8	Electrician Screw Driver thin stem insulated handle, 250 mm	20 Nos.
9	Punch Centre , 150 mm X 9 mm	20 Nos.
10	Knife Double Bladed Electrician	20 Nos.
11	Neon Tester	20 Nos.
12	Steel Rule 300 mm	20 Nos.
13	Hammer, cross peen with handle	20 Nos.
14	Hammer, ball peen With handle	20 Nos.
15	Gimlet 6 mm.	20 Nos.
16	Bradawl	20 Nos.
17	Scriber (Knurled centre position)	20 Nos.
18	Pincer 150 mm	20 Nos.
19	Wire Stripper	20 Nos
20	Tennon Saw 250 mm	20 Nos
21	Firmer chisel wood 12mm	20 Nos

B. SHOP TOOLS, INSTRUMENTS & MACHINERY

Should be available separately in Workshop for (TT-2)

Sl. No.	Name of the items	Quantity
1	C- Clamp 200 mm, 150 mm and 100 mm	2 Nos each
2	Spanner Adjustable 150 mm, 15 degree	2 Nos
3	Blow lamp 0.5 ltr	2Nos
4	Melting Pot	1No
5	Ladel	2Nos
6	Chisel Cold firmer 25 mm X 200 mm	2 Nos
7	Chisel 25 mm & 6 mm	4 Nos each
8	Hand Drill Machine 0 to 6 mm capacity	1No
9	Portable Electric Drill Machine 6 mm capacity	1No
10	Pillar Electric Drill Machine 12 mm capacity	1No
11	Allen Key	1 set
12	Oil Can 0.12 ltr	2 Nos
13	Grease Gun	1 No
14	Out Side Micrometer 0 to 25 mm	1No
15	Motorised Bench Grinder	1No
16	Rawl plug tool & bit	2 set
17	Pully Puller 3 legs 250 mm adjustable	2Nos
18	Bearing Puller 3 legs 120 mm flexible	2Nos
19	Hydrometer	2 set
20	Thermometer 0 to 100 deg Centigrade	1No
21	Scissors blade 150 mm	4 Nos
22	Crimping Tool	1 set
23	Crimping Tools Heavy duty	2 Nos
24	Chisel Cold flat 12 mm	2 No
25	Mallet hard wood 0.50 kg	4 No
26	Hammer Exeter type 0.40 kg	8 nos
27	Hacksaw frame 200 mm 300 mm adjustable	4 Nos
28	Try Square 150 mm blade	4 Nos
29	Outside & Inside Divider Calliper	2 Nos each
30	Pliers flat nose 100 mm	4 Nos
31	Pliers round nose 100 mm	4 Nos
32	Plier longnose 150 mm	4 Nos
33	Tweezers 100 mm	4 Nos
34	Snip Straight & Bent 150 mm	2 Nos each
35	Spanner D.E. metric standard	4 Nos
36	Drill hand brace 0 to 100 mm	4 Nos
37	Drill S.S. Twist block 2 mm, 5 mm 6 mm set of 3	4 set
38	Plane, smoothing cutters 50 mm	4 Nos.
39	Gauge, wire imperial (SWG)	4 Nos
40	File flat 200 mm 2 nd cut	8 Nos.
41	File half round 200 mm 2 nd cut	4 Nos
42	File round 200 mm 2 nd cut	4 Nos.

43	File flat 150 mm rough	4 Nos.
44	File flat 250 mm bastard	4 Nos.
45	File flat 250 mm smooth	4 Nos.
46	File Rasp, half round 200 mm bastard	4 Nos.
47	Soldering Iron 25 watt, 65 watt, 125 watt	4 Nos each
48	Copper bit soldering iron 0.25 kg.	4 Nos.
49	De soldering Gun	4 Nos
50	Hand Vice 50 mm jaw	4 Nos
51	Table Vice 100 mm jaw	8 Nos.
52	Pipe Cutter to cut pipes upto 5 cm. dia	2 Nos.
53	Pipe Cutter to cut pipes above 5 cm dia	1 No.
54	Stock and Die set for 20 mm to 50 mm G.I. pipe	1 No.
55	Ohm Meter; Series Type & Shunt Type	1 No. each
56	Stock and Dies conduit	4 Nos
57	Multi Meter (analog) 0 to 1000 M Ohms, 2.5 to 500 V	1 No
58	Digital Multi Meter 3 ½ digit	8 Nos
59	A.C. Voltmeter M.I. 0 –500V A.C	1 No
60	Milli Voltmeter	6 Nos
61	D.C. Milliammeter 0 -500m A (Digital+ Analog)	1 No.
62	Ammeter MC 0-1A, 0-5 A, 0- 25 A	1 No.
63	A.C. Ammeter	2 Nos each
64	A.C. Ammeter M.I 0-10 -20 A, 0-15-25 A	2 Nos each
65	Kilo Wattmeter 0-5 kw (CC-0-5-10 A,PC-0-250-500V)	2 Nos
66	A.C. Energy Meter,Single phase 5 amp. Three Phase 15 amp	2 Nos
67	Power Factor Meter single phse-230 volt (Analog+ Digital)	1 No each
68	Frequency Meter (Analog+Digital)	1 No each
69	Tachometer with stop watch (Analog + Digital)	1 No each
70	Current Transformer Primary-0-10-20 A, Sec- 5 A)	2Nos
71	Potential Transformer(0-230-400V/110V)	2 Nos
72	Growler Internal+ External	1 No each
73	Tong Tester / Clamp Meter 0 – 100 amp. AC Analog+ Digital)	1No
74	Megger 500 volts	1No
75	Wheat Stone Bridge with galvanometer & battery	1No
76	Earth Tester 0-30 Ohm	2 No
77	Contacto r & auxiliary contacts 3 phase, 440 volt, 32 amp.	1 No each
78	Load Bank5 KW(Lamp / heater Type)	1No
79	Brake Test arrangement with two spring balance 0 - 25 kg rating	2 set
80	DC Power Supply 0-440v , 15A	2 Nos.
81	Inverter- 1 KVA with 12 V Battery Input- 12 volt DC, Output- 220 volt AC	1 No
82	Voltage Stabiliser Input: 150 – 230 volt AC Output: 220 volt AC , 1 KVA	1 No
83	Rheostat 0 -1 Ohm, 5 Amp 0 -10 Ohm, 5 Amp 0- 25 Ohm, 10 Amp 0- 300 Ohm, 3 Amp	2 Nos. each
84	Flux meter	2 Nos
85	Laboratory Type Induction Coil	1 no

EQUIPMENTS & MACHINERY for TT-2

Sl. No.	Name of the items	Quantity
1	Domestic Appliances- a. Electric Hot Plate 1500 watt, 220v With temp. control b. Electric Kettle, 1750watts, 230v c. Electric Iron 1500 watts, 230v with temp. Control d. Immersion Heater 750/1000/1500 watt, 230V e. A.C. Fan 230v f. Geyser (Storage type) 25 ltr minimum, 230V g. Mixture & Grinder h. Microwave Oven 20 lp ltr convection i. Washing Machine 6.5 kg fully automatic j. Hair Drier	2 Nos 2 Nos 2 Nos 2 Nos 2 Nos 1 No 2 Nos 2 Nos 1 No 2 Nos
2	<u>Electrical Machine Trainer – (COMMON FOR TT1 & TT 2)</u> Suitable for demonstrating the construction and functioning of different types of DC machines and AC machines (single phase and three phase). Should be fitted with friction brake arrangement, dynamo meter, instrument panel and power supply unit	1No
3	<u>Motor-Generator (AC to DC) consisting of : (COMMON FOR TT1 & TT 2)</u> Squirrel Cage Induction Motor with star delta starter and directly coupled to DC shunt generator and switch board mounted with regulator, air breaker, ammeter, voltmeter, knife blade switches and fuses, set complete with case iron and plate, fixing bolts, foundation bolts and flexible coupling. <u>Induction Motor rating:</u> 7 HP, 400V, 50 cycles, 3 phase <u>DC Shunt Generator rating:</u> 5 KW, 440V	1No
4	<u>Motor Generator (DC to AC) set consisting of -</u> Shunt Motor with starting compensator and switch directly coupled to AC generator with exciter and switch board mounted with regulator, breaker, ammeter, voltmeter frequency meter, knife blade switch and fuses etc. Set complete with cast iron bed plate, fixing bolts, foundation bolts and flexible coupling <u>Shunt Motor rating :</u> 5 HP, 440V <u>AC Generator rating :</u> 3-Phase, 4 wire, 3.5 KVA, 400/230 Volts, 0.8 pf, 50cycles	2 Nos
5	<u>Relays-</u> a. Cut out b. Reverse current c. Over current d. Under voltage	1 No each
6	<u>Starters for 2 to 5 H.P. A.C Motors-</u> a. Resistance type starter b. Direct on line Starter c. Star Delta Starter-manual, semi-automatic and automatic d. Auto Transformer type	1 No each

7	Thyristor /IGBT controlled D.C. motor drive with Techo - generator feedback arrangement. 2 HP	1 No
8	Thyristor /IGBT controlled A.C. motor drive with VVVF control 3 Phase, 2 HP	1 No
9	Diesel Generator Set with change over switch, over current breaker and water-cooled with armature, star-delta connections AC 3 phase, 5 KVA, 230 volt	1No
10	AC Squirrel Cage Motor with star delta starter and triple pole iron clad switch fuse. 2 to 3 HP, 3-phase ,400 volts, 50 cycles	2Nos
11	AC phase-wound slip ring Motor with starter and switch 5 HP, 400 volts, 3-phase, 50 cycles	1No
12	A.C. Series type Motor with mechanical load ¼ HP, 230V, 50 cycles	1No
13	Single Phase Capacitor Motor with starter switch 1 HP 230 volt 50 cycles	1No
14	Universal Motor with starter/switch 230 volt, 50 cycles ¼ HP	1No
15	Stepper Motor with Digital Controller	1No
16	Shaded Pole Motor	1No
17	Servo Motor with Control	1 No
18	Synchronous scope Meter	2 Nos
19	Phase Sequence Meter	2 Nos
20	Cut model of 3 phase induction motor	1 No
21	Cut model of watermill and hydro power	1 No each
22	Component of Typical small hydro power unit	1 set
23	Component of Typical water mill	1 set

FURNITURES in workshop for TT 2

Sl. No.	Name of the items	Quantity
1	Instructor's table	1 No
2	Instructor's chair	2 Nos
3	Metal Rack 100cm x 150cm x 45cm	4 Nos
4	Working Bench 2.5 m x 1.20 m x 0.75 m	4 Nos
5	Lockers with 2 drawers standard size	2 Nos
6	Almirah 2.5 m x 1.20 m x 0.5 m	1 No
7	Black board/white board	1 No
8	Fire Extinguisher	2 Nos
9	Fire Buckets	4 Nos

NOTE :

1. No additional item except those under trainees kit are requires to be provided for a second batch.

FURNITURE, ACCESSORIES AND AUDIO VISUAL AIDS FOR TT1 AND TT-2

Sl. No.	Name of the items	Quantity
1	Class Room Chairs (armless)/ Dual desk may also be allowed	20/10 nos
2	Class Room Tables (3ft X 2 ft)/Dual desk may also be allowed	20/10 nos
3	Chair for Trainer (armed) Movable	1 no.
4	Table for Trainer (4 ½ ft X 2 ½ ft)with drawer and cupboard	1 no.
5	LCD/LED Projector	1 no.
6	Multimedia Computer System with all accessories with UPS(.5KVA)	1 set
7	Computer Table	1 no.
8	White Board (6 ft X 4 ft)	1 no.
9	LCD Projector Screen	1 no.
10	Air Conditioner 1.5 T on (OPTIONAL)	2 nos.
11	Wall Clock	1 no
12	Wall charts, Transparencies and DVDs related to the trade	As required