

Upgradation of ITIs into Centres of Excellence-
Broad guidelines for implementation of Advanced Module of Sector
“ELECTRICAL ”.

These Centres will be providing multiskill training to meet the skill requirement of particular sector of industry with their active involvement in all aspects of training. The training will be provided in three parts as given below:

- ◆ Training in Basic skill areas for a period of one year.
- ◆ Training in Advanced modules of six months duration after Broad based basic Training(BBBT)
- ◆ Testing & Certification both for the Broad Based Basic Training & Advanced Module Training during subsequent six months will be conducted under the aegis of NCVT .
- ◆ Training in specialized modules mainly by the industry (The course curricula, duration etc will be designed in consultations with the IMC/local industry). The trade testing & certification for specialized module will be done jointly by the State Government & Industry. Said certificate will have recognition from NCVT
- ◆ As per the recommendations of the EFC, Training in the shop floor should constitute atleast 25-40% of the curriculum.

The training programme will have multi-entry and multi-exit provisions as given below:

- trainee can opt to go to the labour market after completing broad based basic training of one year duration or after completing advanced module/s.
- multi-entry and multi-exit provisions would enable a trainee to take admission for advanced/ additional advanced /specialized module as per his/her need .

Guidelines for Training in Advanced modules

- A minimum of three modules would be essentially needed , so as to ensure that all the 96 trainees are accommodated in the three modules may be selected in consultation with IMC for which in two shifts .
- If it is felt that available modules for which the course curricula has been developed at National Level are not sufficient to cater to the needs of local industry in a particular state, States are free to select module as per need in consultation with industry . They may develop suitable module(s) accordingly in consultations with the industry clearly indicating tool & equipment list , instructor qualifications , space norms etc. & forward the same to DGE&T for seeking approval of NCVT.
- A trainee at a time can opt only for one Advanced Module .
- Admission Criteria, Space requirement, Qualification of instructor of the various modules of **“Electrical ”** sector are attached herewith.

Admission to Advanced Module for the graduates of ITI in related trades:

There is a provision for lateral entry for graduates of ITIs (NTC /NAC passed outs from conventional system) of the related trades subject to availability of seats in Advanced Module. Trades of conventional system mentioned against each advanced module in the enclosed statement, could be offered admission in Advanced Module .

MODULE NO.	NAME OF THE MODULE	Admission criteria	Min Space requirement	Du ration In Weeks	Qualificati on/ Status Of Instructor
EAT-01	Repair & Maintenance of Domestic Appliances	Completed BBBT in Sector Electrical OR NTC/NAC in Electrician , Consumer Electronics or any other related trade OR Diploma in Electrical Engineering .	70 sq m	24 weeks	Degree in Electrical with minimum two years teaching/indu strial experience in the relevant field OR Diploma in Electrical with min four years teaching/indu strial experience in the relevant field OR HNTC in Related area with min five years teaching/indu strial experience in the relevant field .
EAT-02	Repair and Maintenance of Instruments used in Electrical Engineering	Completed BBBT in Sector Electrical OR NTC/NAC in Electrician or any other related trade OR Diploma in Electrical Engineering			
EAT-03	Operation & Maintenance of Equipments used in HT, LT, Substation & Cable Jointing	Completed BBBT in Sector Electrical OR NTC/NAC in Electrician or any other related trade OR Diploma in Electrical Engineering			
EAT-04	Non-Conventional Power Generation, Battery and Inverter	Completed BBBT in Sector Electrical OR NTC/NAC in Electrician or any other related trade OR Diploma in Electrical Engineering			
EAT-05	Repair & Maintenance of Electrical Machine & Power Supply	Completed BBBT in Sector Electrical OR NTC/NAC in Electrician or any other related trade OR Diploma in Electrical Engineering			

SECTOR: ELECRICAL ENGINEERING

**MODULE-EAT.0 1 : REPAIR & MAINTENANCE OF DOMESTIC
APPLIANCES**

Duration - 06 months

Objectives :

- To interpret information about a particular domestic appliances
- To test and identify a defect in domestic appliances
- To repair & maintain domestic appliances

Course Contents

THEORY

- Introduction, Importance of maintenance, Common faults on electrical side as well as mechanical side, Method of removing the faults & Importance of preventive maintenance.
- Types of conductors, their properties and use in electricity, Types of insulators, their properties and use in electricity.
- Uses of common instruments like Voltmeter, Amp Meter, Multimeter, Cable fault locator, Growler, etc.
- Study of winding Principles, construction, fault finding, replacement of
 - a) Toaster
 - b) Iron
 - c) Washing Machines
 - d) Vacuum Cleaner
 - e) Dish Washer
 - f) Fan
 - g) Mixer & Grinder
 - h) Blender
 - i) Oven
 - j) Heater
 - k) Convector
 - l) Micro Wave oven

- m) Geyser
- n) Water lifting pump.
- o) Automatic water level controller
- p) Desert cooler.

Study of thermostatic switches.

Precautions to be observed while checking the appliances, Checking the condition of mechanical parts and their replacement, Balancing the rotating parts(magnetically and mechanically).

PRACTICAL

- Method of dismantling of electrical appliances like Mixture, Grinder, Blender, Oven, Heaters, Heat Convector, Microwave, Geyser, Toaster, Iron (Thermostatic & cord less), Washing Machines(semi auto matic & fully automatic)Vacuum Cleaner, Dish Washer, Fan & Micro Wave, etc.
- Method of testing the insulation resistance.
- Methods of checking the condition of appliances.
- Testing and repairing of protective device.
- Test and repairing of controlling device.
- Method of locating the faults in appliance i.e. open circuit, short circuit, earth leakage, etc.
- Overhauling, Oiling and greasing the rotating parts of the appliances and their replacement.
- Method of increasing the insulation resistance.
- Method of baking the varnishing.
- Testing the armature (Growler test).
- Study of MCB,ELCB and Earth leakage circuit breaker..

Terminal Objective :

After completion the participants will be able to

- ✓ identify & test various components used in domestic appliances
- ✓ handle the domestic appliance.
- ✓ identify faults of different stages
- ✓ repair & maintain domestic appliances

LIST OF TOOLS & EQUIPMENTS (For EAT.01)

Repair & Maintenance of Domestic Appliances

NUMBER OF UNITS ONE (16 trainees)

(A) TRAINEES TOOL KIT

Sr. No.	Name of Items	No.s Required	Remarks
1.	Measuring Tape Steel 100cm	17 Nos.	
2.	Rule Steel 300cm	17 Nos.	
3.	Screw Driver heavy duty 200mm insulated thick stem	17 Nos.	
4.	Screw Driver heavy duty 250mm with insulated thick stem handle	17 Nos.	
5.	Plier Insulated combination 200 mm	17 Nos.	
6.	Knife double blade electrician 100mm	17 Nos.	
7.	Pincer 150mm	17 Nos.	
8.	Scriber 150mm x 4mm	17 Nos.	
9.	Punch center 150mm x 8mm	17 Nos.	
10.	Hammer ball pien 0.75kg with handle	17 Nos.	
11.	Hammer cross pien 115gms with handle	17 Nos.	
12.	Saw Tenon 250mm	17 Nos.	
13.	Firmer chisel wood 12mm	17 Nos.	
14.	Gimlet 6mm	17 Nos.	
15.	Bradawl 100mm	17 Nos.	
16.	Wire stripper 150 mm	17 Nos.	
17.	Heat sink plier	17 Nos.	
	(B) TRAINEE'S PERSONAL TOOL KIT	Quantity Required	
1	Voltage sensor (pencil type)/ Electronic Tester	1 No	To be brought by Trainees.
2.	Screw Driver Kit (Set of six blades with common insulated handle with neon tester)	1 No	
3.	Plier insulated 150 mm	1 No	
4	Multimeter	1 No	
5.	Soldering iron,15W,230 V(temperature controlled)	1 No	

List of Tools & Equipments of Workshop for module EAT-.01

S.No.	Name of Item	Quantity	Remarks
1.	Screw Driver 100 mm with handle	4 Nos.	
2.	Screw driver kit (set of six blades with common insulated handle)	4 Nos.	
3.			
4.	Screw Driver 150 mm with insulated handle	4 Nos.	
5.	Plier insulated 200 mm	4 Nos.	
6.	Plier round nose 100 mm	4 Nos.	
7.	Tweezer 100 mm	4 Nos.	
8.	Wire stripper 200 mm	4 Nos.	
9.	Soldering iron 25 watt , 65 watt ,250 watt	2 Nos.Each.	
10.	Desoldering pump.	2 Nos.	
11.	Soldering gun	2 Nos.	
12.	Soldering iron 250 watt.	2 Nos.	
13.	Drill machine electric portable 0 to 6mm capacity	1 No.	
14.	Allen Key	1 set.	
15.	Oil can 0.12 liter	4 Nos.	
16.	Grease gun (small size).	! No.	
17.	Grinder Bench Motorised	1 No.	
18.	Hammer hard plastic with handle	2 Nos.	
19.	Hammer Ball Pein 0.4 Kg.	4 Nos.	
20.	Spanner Kit (Double ended).	1 set.	
21.	Hacksaw frame 300mm	4 Nos.	
22.	Hacksaw frame200mm	4 Nos.	
23.	Snip straight 150mm	4 Nos.	
24.	Drill SS twist block (2 mm – 8 mm)	1 set.	
25.	File flat 200mm smooth	2 Nos.	
26.	File round 200mm 2 nd cut	2 Nos.	
27.	File half round 250mm.	2 Nos.	
28.	File triangular 150mm	2 Nos.	
29.	Vice hand 50mm jaw	4 Nos.	
30.	Vice table 150 mm jaw	2 Nos.	
31.	Pipe cutter to cut 5cm dia.	2 Nos.	
32.	Crimping Tool	2 Nos.	
33.	Multi meter (digital)	2 Nos.	
34.	Ammeter AC, 0 –1 A .	1 No.	
45.	Ammeter M.I. 0 – 5 – 10 – 15 A	2 Nos.	
36.	Voltmeter M.I. 0 – 150 – 300 – 600 V	2 Nos.	
37.	Wheat stone measuring Bridge (complete with galvanometer and Battery)	1 No.	
38.	Megger 500 V	1 No.	
39.	Watt meter single phase 1 KW	1 No.	
40.	BA taps and Dies 0-2-4-6-8 sizes	1 set.	
41.	Variable Auto Transformer	1 No.	
42.	Mixture Grinder	1 No.	
43.	Oven Thermostatic type.	1 No.	
44.	Heat convector	1 No.	
45.	Microwave Oven	1 No.	
46.	Electric Iron (Automatic)	1 No.	

47.	Electric Iron Thermostatic with steam	1 No.	
48.	Electric Iron Thermostatic (light weight).	1 No.	
49.	Geyser (Thermostatic)	1 No.	
50.	Vacuum Cleaner	1 No.	
51.	Dish Washer	1 No.	
52.	Blender	1 No.	
53.	Washing Machine (Semi Automatic)	1 No.	
54.	Washing Machine (Fully Automatic)	1 No.	
55.	Kitchen Fan	1 No.	
56.	Toaster	1 No.	
57.	Watt meter single phase, single element (Flush mounting type) multi Range: 0-750-1500 Watt. rectangular shape.	1 No.	
60.	Ammeter MI type, Rectangular shape, flush mounting,size106x84mm, multi range, 0-5-10 A.	4 No.	
61.	Voltmeter MC type AC,Rectangular shape, flush mounting,size106x84mm,multi range,0-150-300 V.	4No. .	
62.	Auto Transformer, continuous variation, single phase, flush mounting type, 0- 270 V, 5 A.	2 Nos.	
63.	Earth leakage circuit breaker.		
	Water lifting pump (FHR) 1 hp	2 Nos.	
64.	Automatic water level controller	1	
	Desert cooler		
65.	Spanner set various types	8 Nos.	
	Furniture	.	
66.	Locker cup board 195cmx110cm with 45 x 45 x 45 cm locker	2 Nos. each	
67.	Bench working 2.5X1.20X0.75 meter	2 Nos.	
68.	Almirah 2.5X1.20X0.75 meter	2 Nos.	
69.	Instructor chair	1 Nos.	
70.	Instructor table.	1	
71.	Student chair (steel) and table	16 Nos.	
72.	Lecture table	1	
73.	Revolving stool	16 Nos.	
.74	Writing white board	1 Nos.	
.75	Table teak wood for Electrical Lab size 72 x 24 x 30 cm height, provided with drawers and storage, fitted with panel board size 15x 25 x 12 cm height.	2 Nos.	
	Metal rack 180 X 150 X 45 cm		

SECTOR: ELECTRICAL

MODULE EAT.02 REPAIR AND MAINTENANCE OF INSTRUMENTS USED IN ELECTRICAL ENGINEERING

Duration : 06 Months

Objectives :

- To interpret information about a particular device
- To test and identify a defective Instrument
- To repair & maintain a testing Instrument
- To check the accuracy of Instruments.
- To extend the range of Instruments.

Course contents

THEORY:

1.Introduction of instruments, need of instruments in industry.

2.Classification of instruments as: -

- (a) Absolute & Secondary Instruments.
- (b) Analog & Digital Instruments.
- (c) Indicating type Instruments.
- (d) Recording type Instruments.
- (e) Integrating type Instruments. –

3. Review of electronics and digital electronics.

4. Analog to digital and Digital to analog conversion.

---Their principle of operations. Basic requirements of analog Instruments.

3.Instruments commonly used in power system, their construction, working, Limitations, Merits & Demerits.

(a)Voltmeter & Ammeter:

- i. Moving iron type (Attraction & Repulsion type) instruments.
- ii. Moving coil type (Permanent magnet type & Dynamometer type) instruments.
- iii. Hot wire type instruments.
- iv. Induction type instruments
- v. Electrostatic type instruments.
- vi. Digital instruments.

(b) Wattmeter:

- i. Dynamometer type instruments.
- ii. Induction type instruments. –(Single phase & Three phase)
- iii. Electrolytic meter instruments.
- iv. Motor type meter instruments.

(c) Energy meter:

- i. Induction type energy meter. (1-phase & 3-Phase)
- ii. Electrostatic type energy meter.
- iii. Electronic type energy meter (Attraction type, Quadrant type.)

- iv. Digital Energy meter (single phase & three phase).
- (d) Frequency meter:**
 - i. Vibrating type.
 - ii. Electrodynamics type.
 - iii. Moving iron type.
- (e) Power factor meter:**
 - i. Electrodynamics type
 - ii. Moving iron type.
- (f) Multimeter:**
 - i. Analog type
 - ii. Digital type
- (g) Megger:(Analog &Digital)**
Its construction, working and uses.
- (h) Tong tester (Analog and Digital):**
Its construction, working and uses.
- (i) CRO:**
Its construction, working and uses.
- (j) Signal generator:**
Its construction, working and uses.
- (k) Sources of error in instrument, their checking and remedies & calibration.
- (l) Phase sequence tester.
- (m) Synchroscope
- (n) Earth tester
- (o) Tri-vector meter.
- (p) Lux meter
- (q) Extension of meter range:**

A. For D.C. Meter

- i. Using Shunt.
- ii. Using multiplier

B. For A.C. Meter

- i. Using Current Transformer
- ii Using Potential Transformer.

PRACTICAL

- Identification and testing of different components of: -
 - (I) Voltmeter & Ammeter
 - (II) Wattmeter & Energy meter.
 - (III) Multimeter & Tong Tester.
 - (IV) Power Factor Meter
 - (V) Frequency Meter.
 - (VI) Megger & Ohm meter.
 - (VII) CRO & Signal Generator.
- To check the accuracy of different meters and rectify the error in DC and AC work.

- Prepare/Replace a Shunt for extend the range of DC Ammeter.
- Prepare/Replace a multiplier for extend the range of DC voltmeter.
- Check and repair the current transformer.
- Check and repair the Potential Transformer.
- Prepare a current transformer to extend the range of AC Ammeter
- Prepare a Potential transformer to extend the range of AC voltmeter.
- Conversion of DC voltmeter into AC voltmeter to measure the AC voltage.
- To check and rectify the defects in various instruments.
- Study the wattmeter and measure the power of 3-phase load.
- Conversion of KW meter into KVAR meter.
- Study the digital voltmeter and ammeter.
- Study and repair the digital multi meter.
- Study and assemble of CRO.
- Study and assembly of signal generator
- Practical on electronics, analog to digital and digital to analog conversion.

Terminal Objective

After completion the participants will be able to

- ✓ identify the instrument and handle it properly.
- ✓ repair all type of analog and electronic instruments
- ✓ check and calibrate the instrument.
- ✓ select the instrument for specific job
- ✓ extend the measuring range of instruments.

-X-X-X-X-X-X-X-X-X-X-X-

LIST OF TOOLS & EQUIPMENTS (For Module EAT-02)
Repair and Maintenance of Instruments used in Electrical Engineering.

SECTOR: CRAFTSMAN ELECRICAL ENGINEERING

NUMBER OF UNITS ONE (16 trainees)

(B) TRAINEES TOOL KIT

Sr. No.	Name of Items	No.s Required	Remarks
1.	Measuring Tape Steel 100cm	17 Nos.	
2.	Rule Steel 300cm	17 Nos.	
3.	Screw Driver heavy duty 200mm insulated thick stem	17 Nos.	
4.	Screw Driver heavy duty 250mm with insulated thick stem handle	17 Nos.	
5.	Plier Insulated combination 200 mm	17 Nos.	
6.	Knife double blade electrician 100mm	17 Nos.	
7.	Pincer 150mm	8 Nos.	
8.	Scriber 150mm x 4mm	8 Nos.	
9.	Punch center 150mm x 8mm	8 Nos.	
10.	Hammer ball pien 0.75kg with handle	4 Nos.	
11.	Hammer cross pien 115gms with handle	8 Nos.	
12.	Saw Tenon 250mm	2 Nos.	
13.	Firmer chisel wood 12mm	2 Nos.	
14.	Gimlet 6mm	17 Nos.	
15.	Bradawl 100mm	17 Nos.	
16.	Wire stripper 150 mm	17 Nos.	
17.	Heat sink plier	17 Nos.	
18.	Teezer	17 Nos.	
19.	Hand vice	4 Nos.	
20.	Pipe vice	2 Nos	
21.	Bench vice	4Nos	
	(B) TRAINEE'S PERSONAL TOOL KIT	Quantity Required	
1	Voltage sensor (pencil type)	1 No	To be brought by Trainees.
2.	Screw Driver Kit (Set of six blades with common insulated handle with neon tester)	1 No	
3.	Plier insulated 150 mm	1 No	
4	Multimeter	1 No	
5.	Soldering iron,15W,230 V(temperature controlled)	1 No	

List of Tools & Equipments for Workshop of module EAT-.02

1.	Screw Driver 100 mm with handle	10 Nos.	
2.	Screw driver kit with line tester (six bit)	8 Nos.	
3.	Screw Driver 150 mm with insulated handle	4 Nos.	
4.	Plier insulated 200 mm	4 Nos.	
6.	Plier round nose 100 mm	4 Nos.	
8.	Tweezer 100 mm	8 Nos.	
9.	Scissor 150mm blade	2 Nos.	
10.	Wire stripper 1500 mm	8 Nos.	
11.	Soldering iron 25 watt , 65 watt ,250 watt	4 Nos.	
12.	Desoldering pump.	8 Nos.	
13.	Soldering gun	2 Nos.	
14.	Soldering iron 250 watt.	4 Nos.	
15.	Drill machine electric portable 0 to 6mm capacity	4 Nos.	
16.	Allen Key	One set	
17.	Oil can 0.12 liter	4 Nos.	
18.	Hammer hard plastic with handle	4 Nos.	
19.	Snip straight 150mm	4 Nos.	
20.	Snip straight 100mm	4 Nos.	
21.	Drill SS twist block (2mm to 6mm)	One set	
22.	File flat 100mm smooth	4 Nos.	
23.	File triangular 150mm	4 Nos.	
24.	File Needle Smooth	4 Nos.	
25.	Vice hand 50mm jaw	4 Nos.	
26.	Crimping Tool for VTP/RJ 45	4 Nos.	
27.	Crimping Tool for co-axial/BNC	4 Nos.	
28.	Portable Ammeter M.C. 0 –1 A	4 Nos.	
29.	Portable Ammeter 0-500mA	4 Nos.	
30.	Portable Ammeter M.I. 0 – 5A	4 Nos.	
31.	Portable Ammeter M.C. 0 –5 A	4 Nos.	
32.	Portable Voltmeter M.I. 0 – 150 – 300 – 600 V	4 Nos.	
33.	Portable Voltmeter M.C. 0 – 150 – 300 – 600 V	4 Nos.	
34.	Portable Ammeter (Digital)	2 Nos.	
35.	Portable Voltmeter (Digital)	2 Nos.	
36.	Wattmeter 1kw single phase dynamometer type	2 Nos.	
37.	Portable wattmeter 3 phase 3kw dynamometer type	2 Nos.	
38.	Wattmeter induction type 1kw single phase	2 Nos.	
39.	Portable Wattmeter digital type 1KW	2 Nos.	
40.	Portable Frequency meter vibrating type	2 Nos.	
41.	Portable Frequency meter digital	2 Nos.	
42.	Portable Frequency meter electro dynamo type	2 Nos.	
43.	Portable Power Factor meter 0.5-1-05 single phase electro- dynamic type	2 Nos.	
44.	Portable Power Factor meter moving iron type	2 Nos.	
45.	Portable Power Factor meter 400V, 3 phase	2 Nos.	
46.	Portable Power Factor meter, single- phase digital	2 Nos.	
47.	Portable VAR meter	2 Nos.	
48.	Magnetic flux meter	2 Nos.	
49.	Wattmeter electrolytic type	2 Nos.	
50.	Energy meter 1phase 230V 5A induction type	2 Nos.	
51.	Energy meter 3phase 400V 5A	2 Nos.	

52.	Energy meter electronic type (Attraction type)	2 Nos.	
53.	Energy meter solid state 1 phase	2 Nos.	
54.	Energy meter solid state 3 phase	2 Nos.	
56.	LCR Bridge	2 Nos.	
57.	Meggar analog type 500V	2 Nos.	
58.	Meggar Digital	2 Nos.	
59.	Multimeter Digital and Analog.	2 Nos.	
60.	Tong Tester	2 Nos.	
61.	CRO	2 Nos.	
62.	Signal Generator	4 Nos.	
63.	Current Transformer	4 Nos.	
64.	Potential Transformer	4 Nos.	
65.	Potentiometer	2 Nos.	
66.	Phase sequence tester.	2 Nos.	
67.	Stroboscope.	2 Nos.	
68.	Tecometer.	2 Nos.	
69.	Earth tester.	1 No.	
70.	Watt meter single phase, single element (Flush mounting type) multi Range: 0-750-1500 Watt. rectangular shape.	4 No.	
71.	Ammeter MI type, Rectangular shape, flush mounting,size106x84mm, multi range, 0-5-10 A.	4 No.	
72.	Voltmeter MC type AC,Rectangular shape, flush mounting,size106x84mm,multi range,0-150-300 V.	4 No.	
73.	Auto Transformer, continuous variation, single phase, flush mounting type, 0- 270 V, 5 A.	4 No.	
74.	Desert cooler.	1 No.	
	Furniture		
75.	Locker cup board 195cmx110cm with 45 x 45 x 45 cm locker	1 No.	
76.	Bench working 2.5X1.20X0.75 meter Almirah 2.5X1.20X0.75 meter	2 Nos.	
77.	Instructor chair	1 Nos	
78.	Instructor table.	1 Nos.	
79.	Student chair (steel) with table	16 Nos.	
81.	Lecture table	1 No	
82.	Revolving stool	16 Nos.	
83.	Writing white board	1	
84.	Table teak wood for Electrical Lab size 72 x 24 x 30 cm height, provided with drawers and storage, fitted with panel board size 15x 25 x 12 cm height.	2 Nos.	
.	Metal Rack180 X 150 X 45 cm	.	

SECTOR: ELECTRICAL

MODULE NO.EAT.03

OPERATION & MAINTENANCE OF EQUIPMENTS USED IN HIGH TENSION Line LOW TENSION LINE SUBSTATION AND CABLE JOINING.

DURATION: 06 months

Objective

- To discuss need of transmission of electric power & its advantages & disadvantages.
- To discuss material used for conductors, insulators and their characteristics.
- To discuss protective devices & Equipments used in substation.
- To repair and maintain equipment used in different types of lines & substations.
- To understand the concept of cable Jointing.

Course contents:

THEORY

- Introduction of transmission of electric power and its necessity.
- Methods of power transmission, their advantages & disadvantage.
 - i. By Alternating current.
 - ii. By Direct current.
 - iii. By Over Head lines.
 - iv. By under ground lines
- Mechanical aspects of overhead line:
 - i. Conductor materials their shapes, size, current density, tensile strength etc.
 - ii. Insulator materials, their dielectric strength etc.
 - iii. Pole and Towers, their shape, size and utility
 - iv. Guards, their necessity in overhead lines and types.
- Electrical aspects of overhead line:
 - i. Resistance of overhead line
 - ii. Inductance of overhead line
 - iii. Capacitance of overhead line
 - iv. Effect of earth
 - v. Formation of corona. & Power loss due to corona and their remedies.
- Underground cables, their construction, types and uses as: -
 - (A) For high voltage transmission lines.
 - i. Oil filled cables
 - ii. High pressure cables
 - iii. Gas filled cables
 - iv. H.S.L. type cable etc.
 - (B) For low voltage transmission (PILC, PILCSTA etc.)
 - (C) Submarine cables
 - Cable jointing, purpose of cable joints and techniques of joints & Faults in underground line & overhead lines and their methods of rectification.
 - Substation construction:
 - i. Out door and Indoor substation.
 - ii. E.H.T. substation
 - iii. H.T. substation
 - iv. Medium & low voltage substation

- Substation Equipments:
- Power Transformer –
Its construction, working, performance, cooling, parallel operation, tap changing and its purpose & selsyn drive.
- Circuit Breakers: -
 - i. Oil circuit breaker, its construction, working and installation.
 - ii. Air blast circuit breaker, its construction, working and installation.
 - iii. SF6 circuit breaker, its construction, working and installation.
 - iv. Vacuum circuit breaker, its construction, working and installation.--
--their voltage grade, utilization & current carrying capacity etc.
- Horn Gap Switches/ Air break switch: Its construction and utilization on HT & lines.
- Disconnect Switch: Its construction and utilization on HT & LT lines.
- Grounding Switch: Its construction and utilization on HT & LT lines.
- Surge Arrestors: Its construction and utilization on HT & LT lines.
- Current Limiting Reactors: Its construction working and utilization on HT& LT lines.
- Instruments Transformer, Current Transformer, Potential Transformer,
Their Construction, working and uses
- Protection of high & medium voltage system
- Protective devices:
 - i. Fused cut outs
 - ii. Recloser circuit breaker.
 - iii. Sectionalizer
- Relays: their types, viz. over current, earth fault relay, wire differential, Buchholz's relays, their operation and maintenance.

Note: Four weeks training in a transmission, distribution and substation at nearby electricity board. Concerned instructor will supervise.

PRACTICAL

- Measurement of resistance of conducting material.
- Measurement of earth resistance.
- Making up a straight splice for different cables.
- Practice of lying of cable in trenches /pipe.
- Jointing of cables in lead sleeves.
- Jointing of cables in epoxy sleeves.
- Termination of cable conductor.
- Earthing of sub station installation.
- Handling and operation of equipment used in transmission line
- Maintenance of transformer equipments such as: - Oil gauge, Tap changer, Bushes Breather, Earth fault relay, Protective relay etc.
- To test / check the polarity of single phase transformer.

- Replacement of oil and testing of its die-electric.
- Recharge the silica gel in breather.
- Study and operation of
- Oil circuit breaker
- Air circuit breaker
- Gas filled circuit breaker
- Vacuum circuit breaker
- MCCB etc.
- Installation of fuses on H.T. Line & L.T. Line
- Replacement of fuse element.
- Detection of faults (open circuit and short circuit) in cable and rectify.
- Filling up the cable-jointing box.
- Testing, Installing and reading of electrical measuring instruments.
- Connections of energy measuring meter through C.T. & P.T.
- Testing and charging of emergency battery.

Terminal Objective

After completion the participants will be able to

- ✓ detect faults in transmission line
- ✓ find faults in conductors and insulators
- ✓ carry out first hand maintenance in sub stations.
- ✓ maintain substation, transformer & safety devices.
- ✓ joint different type of cable used in HT lines& filling up the cable jointing Box.

X-X-X-X-X-X-X-X-X

LIST OF TOOLS & EQUIPMENTS (ForEAT.03)

Operation & Maintenance of Equipments used in HT, LT, Substation & Cable Jointing

NUMBER OF UNITS ONE (16 trainees)

(A) (TRAINEES TOOL KIT

Sr. No.	Name of Items	No.s Required	Remarks
1.	Measuring Tape Steel 100cm	17 Nos.	
2.	Rule Steel 300cm		
3.	Screw Driver heavy duty 200mm insulated thick stem	17 Nos.	
4.	Screw Driver heavy duty 250mm with insulated thick stem handle	17 Nos.	
5.	Plier Insulated combination 200 mm	17 Nos.	
6.	Knife double blade electrician 100mm	17 Nos.	
7.	Pincer 150mm	17 Nos.	
8.	Scriber 150mm x 4mm	17 Nos.	
9.	Punch center 150mm x 8mm	17 Nos.	
10.	Hammer ball pien 0.75kg with handle	17 Nos.	
11.	Hammer cross pien 115gms with handle	17 Nos.	
12.	Saw Tenon 250mm	17 Nos.	
13.	Firmer chisel wood 12mm	17 Nos.	
14.	Gimlet 6mm	17 Nos.	
15.	Bradawl 100mm	17 Nos.	
16.	Wire stripper 150 mm	17 Nos.	
17.	Voltage sensor (pencil type)/ Electronic Tester	1No.	
18.	Screw Driver Kit (Set of six blades with common insulated handle with neon tester)	1No. 1No.	
19.	Plier insulated 150 mm	1No.	
20.	Multimeter	1No.	
21.	Soldering iron 25W, 230 V		
	(B) TRAINEE'S PERSONAL TOOL KIT	Quantity Required	
1	Voltage sensor (pencil type)/ Electronic Tester	1 No	
2.	Screw Driver Kit (Set of six blades with common insulated handle with neon tester)	1 No 1 No	
3.	Plier insulated 150 mm	1 No	
4	Multimeter	1 No	
5.	Soldering iron, 15W, 230 V (temperature controlled)	1 No	

List of Tools & Equipments for Workshop of module EAT-.03

S.No.	Name Of Item	Quantity	Remarks
1.	Screw driver 100 mm.	4 Nos.	
2.	Screw driver 300 mm.	4 Nos.	
3.	Plier Gas 250 mm.	4 Nos.	
4.	Plier Gas 200 mm	4 Nos.	
6.	Plier round Nose 150 mm.	4 Nos.	
8.	Plier Flat Nose 150 mm.	4 Nos.	
9.	Tweezers 150 mm.	2 Nos.	
10.	Blow lamp 2 pint.	2 Nos.	
11.	Melting pot,	1 Nos.	
12.	Soldering Iron 250 watt.	4 Nos.	
13.	Soldering Iron 125 watt.	4 Nos.	
14.	Hammer ball pien 0.4 Kg.	4 Nos.	
15.	Spanner Kit (Double Ended).	1 set.	
16.	Drill machine Hand 0- 8 mm capacity.	1 No.	
17.	Drill machine electric Portable o- 6 mm capacity.	1 No.	
18.	Drill machine electric Portable o-12 mm capacity.	1 No.	
19.	Oil cane 0.12 liter.	4 Nos.	
20.	Allen key.	1set.	
21.	Grease Gun (medium size)	2 Nos.	
22.	Grease Gun (small size).	2 Nos.	
23.	Hack saw frame 300 mm.	4 Nos.	
24.	Hack frame 200 mm.	4 Nos.	
25.	Snip straight 200 mm.	4 Nos.	
26.	Snip curved 200 mm.	4 Nos.	
27.	Rubber Globes pair.	4 Nos.	
28.	Spanner single ended 6mm - 25 mm.	2 set.	
29.	Spanner double ended 6 mm -19 mm.	2 set.	
30.	Drills S.S. twist block 2 mm- 12 mm.	2 set.	
31.	File flat 200 mm 2 nd cut.	4 Nos.	
32.	File flat 200 mm bustard.	4 Nos.	
33.	File round 200 mm bustard.	4 Nos.	
34.	File round 150 mm 2 nd cut.	4 Nos.	
35.	File flat 200 mm smooth.	4 Nos.	
36.	Instrument files (set of 12).	2 set.	
37.	Bench vice 100 mm jaw.	2 Nos.	
38.	Bench vice 150 mm jaw.	4 Nos.	
39.	Tap set 3 mm- 10 mm (set of 9).	2 set.	
40.	Die set 3mm – 10 mm (set of 9).	2 set.	
41.	Vice hand 50 mm jaw.	4 Nos.	
42.	Multi meter (digital).	2 Nos.	
43.	Ammeter MI, 0-25 A.	2 Nos.	
44.	Ammeter MI, 0-5-10-15 A.	2 Nos.	
45.	Tong tester 0-25 –50 A. (multi range).	2 Nos.	
46.	Voltmeter 0- 600 V.	2 Nos.	
47.	C T, (5- 100 A).	2 Nos.	
48.	P T, (1100- 400 V).	2 Nos.	
49.	Megger 1500 V.	2 Nos.	
50.	Megger 2500 V.	2 Nos.	
51.	Megger 500 V.	2 Nos.	
52.	Earth fault locater.	2 Nos.	
53.	Earth tester.	2 Nos.	

54.	Energy meter single phase 40 A 230 V.	2 Nos.	
56.	Energy meter 3 phase 4 wire, 20 A 400 V.	2 Nos.	
57.	Watt meter single phase 230 V, 3 KW.	2 Nos.	
58.	Wattmeter 3 phase 400 V, 2 elements 3/5 KW.	2 Nos.	
59.	Oil circuit breaker 5 KVA.	1 No.	
60.	Air circuit breaker 5 KVA	1 No.	
61.	SF6 circuit breaker	1 No.	
62.	MCB 5 KVA.		
63.	Oil testing kit.	1 No.	
64.	Crimping tool variable	1 No.	
65.	Transformer 5 KVA, oil cooled, fitted with	4 Nos.	
66.	safety/protection devices.	2 Nos.	
67.	Transformer 10 KVA, oil cooled, fitted with		
	safety/protection devices.	1 No.	
68.	Fire extinguisher.		
69.	Fire buckets.	1 No.	
70.	Coil winding machine with Adjustable Frame.	4 Nos.	
	Furniture	1 No.	
71.	Locker cup board 195cmx110cm with 45 x 45 x 45	1 No.	
72.	cm locker	2 Nos.	
73.	Bench working 2.5X1.20X0.75 meter	1 No.	
74.	Almirah 2.5X1.20X0.75 meter	1 No.	
75.	Instructor chair	1 No.	
76.	Instructor table.	3 Nos.	
77.	Student chair and table	16	
78.	Revolving stool	16	
79.	Writing white board	2 Nos.	
.			

SECTOR: ELECTRICAL ENGINEERING

MODULE-EAT.04 NON-CONVENTIONAL POWER GENERATION, BATTERY AND INVERTER

Duration : 06 Months

Objectives :

- To be able to work on various sources for power generation
- Able to analyze various re-power generation sources, renewable
- Applications of power generation sources

Course contents

THEORY

- Power Generation by non-conventional & renewable energy
- Captive Power Plant.
- Introduction to renewable and non-conventional energy, their suitability and limitations.
- Types of Sources for Power Generation:
 - a) Solar
 - b) Wind
 - c) Bio-Mass
 - d) Tidal Waves
 - e) Micro Hydel
- Fuel Cell : Introduction to different types of fuel cells.

Battery :- Electrolysis and Laws of electrolysis and their use in industry.

Cells, types of cells, primary and secondary cells, fuel cell, Hydro-Oxygen cell.

Care and maintenance of lead acid battery.

Charging methods of lead acid battery.

- a) Constant current method.
- b) Constant voltage method.

Troubles shooting in battery and their remedies.

Types of inverter, series and parallel inverter, its construction, testing and protection circuit. SCR, TRIAC, DAIC

Types of Sources for Power Generation

a) Solar : Solar Thermal Power Generation:

- Introduction to low, medium and high solar thermal power generation.
- Efficiency level and basic advantages and disadvantages.

- Solar Photo Voltaic Power Generation
- Basic module of Photo Volatic system :
 - a) Solar Photo Voltaic Cell.
 - b) Charge Controller.
 - c) Storage Battery.
 - d) Inverter.
 - e) Luminative / Load.
- b) Wind :
 - Basic principles of wind energy generation,
 - Types of Wind mills and associated generators.
- c) Bio Mass :

Biomass based power generation.

 - a) Digester type Bio-mass based power generation.
 - b) Gasifier based Bio-mass power generation.
 - c) Night soil based power generation.
- d) Tidal Waves :
 - Introduction to Ocean thermal electric Conversion & Tidal.
- e) Micro Hydel :
 - Introduction to Micro-hydel power generation and water mill.
 - Basic components involved like pin stalk, basic turbine, alternator, etc.
 - Introduction to modified and improved water mill.

PRACTICAL

- To study Solar photo voltaic band for power generation.
- To study Wind Mill for Power Generation.
- To study Bio Mass System for Power Generation.
- To study Micro Hydel/Water Mill for Power Generation.
- To study Wind Mill system for Power Generation.
- Prepare a fuel cell (Hydro – Oxygen cell).
- Assemble Lead Acid cell.
- Preparation of electrolyte for Lead Acid cell.
- Charging the storage battery by: -
 - a) Constant current method.
 - b) Constant voltage method.
 - (c) Trickle charge.
- Modular Approach of repair/ Maintenance of Inverter.
- Assembling of Inverter.
- Fault finding & trouble shooting.

- Solar Inverter (Hybrid)
- Test and rectify the faults in lead acid battery.

Terminal Objective

After completion the participants will be able to

- ✓ use and operate different renewable Sources for Power Generation
- ✓ carry out First hand maintenance.
- ✓ explain the utility of modern renewable Sources for Power Generation.
- ✓ charge the battery & trace out the faults
- ✓ test, rectify, repair and carry first hand maintenance, preventive maintenance and routine maintenance of different equipments used in renewable power generation
- ✓ install different sample system of renewable power generation system

X-X-X-X-X-X-X-X-X

LIST OF TOOLS & EQUIPMENTS FOR EAT-04

Non-Conventional; Energy & Renewable Energy

No. of Units One (16 trainees)

<u>Sr.No.</u>	<u>Description</u>	<u>Quantity</u>
1)	Domestic Light	
a)	Surya Mapi	4 Nos each
b)	True RMS meter	
c)	Digital MultiMate's	
d)	Power supplies 0-24 VDC Variable 0-3A	
e)	L-C-R meter	
f)	D C Voltmeter 0-150 V	
g)	DC Ammeter 0-10 A	
h)	AV Voltmeter 0-300 V	
i)	A V Ammeter 0-10 A	
2)	Solar pump with suitable voltmeter, Ammeter and Wattmeter.	2 Nos
3)	Concentrator Type solar cooker	2 Nos..
4)	Box type solar cooker	2 Nos
5)	Small working model of improved water mill with Flow rate measurements and alternator.	
6)	Small working model of wind Battery charger.	1 Nos
7)	Small working Model of go bar gas plant and night soil biogas gas plant.	
8)	Small working model of gasifier	1 Nos
9)	Screw driver set	17 Nos
10)	Spanner Set	17 Nos
11)	Cutter	17 Nos
12)	Plier	17 Nos

SECTOR: ELECTRICAL ENGINEERING

MODULE NO EAT.05

REPAIR AND MAINTENANCE OF ELECTRICAL MACHINE AND POWER SUPPLY.

Objective:

- To interpret information about a particular electrical Machine& its components.
- To test and identify different components used in machine & power supply unit.
- To repair and maintain all types of machines and power supply units.

Duration:- 06 months

Course contents:

THEORY

- Review of electrical machines such as Three Phase Induction Motor, Single Phase Induction Motor.
- Review of electrical instruments.
- Review of transformer winding.
- Study of active and passive components used in power supply.
- Different measuring instruments used in power supply testing and measurements. (e.g. analog and digital multi - meters, LCR, meters, power and energy meters, frequency counters, CRO etc.
- A.C to D.C. converter (Rectifiers & ripple filters EMI/RFI filters.
- Constant current and voltage source.
- A.C. voltage stabilizer.
- Linear voltage regulator & its types. (Transistorized & IC regulator.)
- Reliability Test/Regulation test of D.C. power supplies.
- Stabilizer with using electronic circuit.
- Protection ckts used in power supply.
- D.C. to A.C. converter, Types of inverter, its different blocks & oscillators ckts.
- Battery changers & its protection ckts.
- UPS working principles of f-line & On line UPS ckts used in UPS.
- CVT working and principles.
- Various circuits used in servo controlled voltage stabilizers.
- SCR power supply ckts.
- SMPS ckts and its types.
- Fault finding & their remedies.

PRACTICAL: -

- Identification & Testing of different active and passive components.
- Supply used of different measuring instruments used in power supply testing and components testing.
- Assemble different types of rectifier & different filters ckts a& calculate its ripple factors.
- Study of current and voltage source ckts using Op- Amp.
- Use of CRO.
- Assembles various voltage stabilizers using step –up transformer.
- Assemble zener Transistor (Series and shunt) and IC regulator 78/79series,741,LM 723 etc.
- Calculate regulation & study of reliability test of above power supply Ckts.
- Assemble ckts (Electronics) with relays used in power supply.
- Study & assembling protection ckts used in power supply.
- Assemble different types of inverters ckts & its measurements.
- Assemble battery changers ckts used in inverters with protection ckts.
- Assemble on –line, Off line UPS & its measurements.
- Assemble CVT & its measurements.
- Assemble /study of SCVS ckts.
- Study & measurements of given SCR power supply ckts.
- Study & Measurements of given SMPS.
- Study fault finding of given power supply.
- Speed control of motors.

Terminal Objective

After completion the participants will be able to ...

- ✓ test different types of components used in electrical machines.
- ✓ to find fault in different types of power supplies.
- ✓ locate faults in CVT, SCVS, SCVT, SMPS, Inverter etc.

-X-X-X-X-X-XX-X-X-X-X-X

LIST OF TOOLS & EQUIPMENTS (For EAT-05)
Repair & Maintenance of Electrical Machine & Power Supply

SECTOR CRAFTSMAN ELECTRICAL ENGINEERING

NUMBER OF UNITS ONE (16 trainees)

(C) TRAINEES TOOL KIT

Sr. No.	Name of Items	No.s Required	Remarks
1.	Measuring Tape Steel 100cm	17 Nos	
2.	Rule Steel 300cm	17 Nos	
3.	Screw Driver heavy duty 200mm insulated thick stem	17 Nos	
4.	Screw Driver heavy duty 250mm with insulated thick stem handle	17 Nos	
5.	Plier Insulated combination 200 mm	17 Nos	
6.	Knife double blade electrician 100mm	17 Nos	
7.	Pincer 150mm	17 Nos	
8.	Scriber 150mm x 4mm	17 Nos	
9.	Punch center 150mm x 8mm	17 Nos	
10.	Hammer ball pien 0.75kg with handle	17 Nos	
11.	Hammer cross pien 115gms with handle	17 Nos	
12.	Saw Tenon 250mm	17 Nos	
13.	Firmer chisel wood 12mm	17 Nos	
14.	Gimlet 6mm	17 Nos	
15.	Bradawl 100mm	17 Nos	
16.	Wire stripper 150 mm	17 Nos	
17.	Heat sink plier	17 Nos	
	(B) TRAINEE'S PERSONAL TOOL KIT	Quantity Required	
1	Voltage sensor (pencil type)	1 No	To be brought by Trainees.
2.	Screw Driver Kit (Set of six blades with common insulated handle with neon tester)	1 No	
3.	Plier insulated 150 mm	1 No	
4	Multimeter	1 No	
5.	Soldering iron, 15W, 230 V (temperature controlled)	1 No	

List of Tools & Equipments for Workshop of module EAT-.05

S. No	Name Of Items	Quantity	Remarks
1.	Screw driver 100 mm.	4 Nos.	
2.	Screw driver 300 mm.	4 Nos.	
3.	Plier Gas 250 mm.	4 Nos.	
4.	Plier Gas 200 mm	4 Nos.	
6.	Plier round Nose 150 mm.	4 Nos.	
8.	Plier Flat Nose 150 mm.	4 Nos.	
9.	Tweezers 100 mm.	4 Nos.	
10.	Soldering Iron 75 watt.	2 Nos.	
11.	Soldering Iron 25 watt.	2 Nos.	
12.	Soldering Iron 65 watt.	2 Nos.	
13.	Soldering gun	2 Nos.	
14.	Spanner Kit (Double Ended).	2 set.	
15.	Drill machine Hand 0- 6 mm capacity.	4 Nos.	
16.	Drill machine electric Portable 0- 6 mm capacity.	1 No.	
17.	AC Bridge.	1 No.	
18.	Oil can 0.12 liter.	4 No.	
19.	Allen key.	1 set.	
20.	Grease Gun (medium size)	1 No.	
21.	Grease Gun (small size).	1 No.	
22.	Hack saw frame 150 mm.	2 Nos.	
23.	Hack frame 200 mm.	4 Nos.	
24.	Snip straight 150 mm.	4 Nos.	
25.	Snip curved 150 mm.	4 Nos.	
26.	Rubber Gloves pair.	4 Nos.	
27.	Spanner single ended 6mm - 25 mm.	1 set.	
28.	Spanner double ended 6 mm -19 mm.	1 set.	
29.	Drills S.S. twist block 2 mm- 12 mm.	2 set.	
30.	File flat 150 mm 2 nd cut.	4 Nos.	
31.	File flat 150 mm bustard.	4 Nos.	
32.	File round 100 mm bustard.	4 Nos.	
33.	File round 150 mm 2 nd cut.	4 Nos.	
34.	File flat 150 mm smooth.	4 Nos.	
35.	Instrument files (set of 12).	1 No.	
36.	Bench vice 100 mm jaw.	2 Nos.	
37.	Tap set 3 mm- 10 mm (set of 9).	2 set.	
38.	Die set 3mm – 10 mm (set of 9).	2 set.	
39.	Vice hand 50 mm jaw.	4 Nos.	
40.	Multi meter (digital).	2 Nos.	
41.	Ammeter MI, 0-2 A.	2 Nos.	
42.	Ammeter MI, 0-5-10-15 A.	2 Nos.	
43.	Tong tester .	2 Nos.	
44.	Voltmeter 0-150-300- 600 V.	2 Nos.	
45.	C T.	2 Nos.	
46.	P T.	2 Nos.	
47.	Frequency meter (Digital & Analog).	2 Nos.	
48.	Megger 500 V.	2 Nos.	
49.	Wheat stone bridge.	1 No.	
50.	Earth fault locater.	1 Nos.	
51.	Earth tester.	1 No.	

52.	Energy meter single phase 40 A 230 V.	2 Nos.	
53.	Energy meter 3 phase, 20 A 400 V.	2 Nos.	
54.	Watt meter single phase 230 V, 3 KW.	2 Nos.	
56.	Wattmeter 3 phase 400 V, 2 elements 3/5 KW.	2 Nos.	
57.	Crimping tool.	2 Nos.	
58.	Signal generator.	2 Nos.	
59.	CRO.	2 Nos.	
60.	LCR meter.	2 Nos.	
61.	Voltage stabilizer.	2 Nos.	
62.	Battery charger Input- 230 V, Output-0-35V.	1 No.	
63.	UPS (On line)	2 Nos.	
64.	UPS (Off Line).	2 Nos.	
65.	CVT.	2 Nos.	
66.	SMPS.	2 Nos.	
67.	Inverter 1 KVA, (MOSFET Tech).	2 Nos.	
68.	AutoTransformer, Input 230V,Output0-270 V.	2 Nos.	
69.	Auto Transformer 3 phase Input 230 V, Output, 0-270 V.	2 Nos.	
70.	Multimeter Analog.	2 Nos.	
71.	Transistor Tester.	2 Nos.	
72.	IC Tester.	2 Nos.	
73.	Microprocessor Kit.	1 No.	
74.	IC Trainer (Digital)	1 No.	
75.	Lead acid battery 60 AH.	1 No.	
76.	Fire Extinguisher.	2 No.	
77.	Fire Buckets.	4 Nos.	
78.	Watt meter single phase, single element (Flush mounting type) multi Range: 0-750-1500 Watt. rectangular shape.	4 No.	
79.	Ammeter MI type, Rectangular shape, flush mounting,size106x84mm, multi range, 0-5-10 A.	4 No.	
81.	Voltmeter MC type AC, Rectangular shape, flush mounting,size106x84mm,multi range,0-150-300 V.	4 No.	
82.	Auto Transformer, continuous variation, single phase, flush mounting type, 0- 270 V, 5 A.	4 Nos.	
83	Furniture		
	Locker cup board 195cmx110cm with 45 x 45 x 45 cm locker	1 Nos.	
84.	Bench working 2.5X1.20X0.75 meter Almirah 2.5X1.20X0.75 meter	4Nos.	
85.	Instructor chair	1Nos.	
86.	Instructor table.	1	
87.	Student chair (steel)	16	
88.	Lecture table	1	
89.	Revolving stool	16 Nos.	
90.	Writing white board	1	
91.	Table teak wood for Electrical Lab size 72 x 24 x	4 Nos.	
92.	30 cm height, provided with drawers and storage,	2 Nos.	
93.	fitted with panel board size 15x 25 x 12 cm height.	2 Nos.	
94.	Metal Rack180 X 150 X 45 cm		

