

Upgradation of ITIs into Centers of Excellence-Broad guidelines for implementation of the scheme for “Industrial 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 for next six months.
The testing & certification for the Basic skill training during first year & also for advanced training during next six months will be conducted by NCVT
- ✓ Training in specialized modules mainly in the industry (The course curricula, duration etc will be designed in consultations with the IMC/local industry. The trade testing & certification for this component will be done jointly by the State Government & Industry. Said certificate will be recognized by 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:

- ✓ trainee can opt to go to the labour market after completing broad based basic training of one year duration as well as after completing 1½ year of training.
- ✓ trainee can come back after some time to seek admission for advanced/specialised training in another module
- ✓ ITI pass out trainee of the particular trade(s) from the conventional system can seek admission for advanced/specialised training

As per the approved curricula in the Area/Sector of “**Industrial Sector Electrical**”, uniform rotation of trainees in six modules each of eight weeks duration as mentioned below is envisaged to be taken up. The trades from where existing infrastructure i.e.

equipment/ instructor etc. could be utilized for the training in ‘**Electrical**’ sector and space requirement of each module is as under:-

Basic Module	NAME OF THE MODULE	Trade(s) from where existing equipment/instructor could be utilised	Minimum Space Requirement (Sq.m)
ECBT - 01	BASIC ENGINEERING SKILL	*Fitter/*Carpentry/ *Sheet Metal/Electronic Mechanic or Mechanic R&TV	80
ECBT – 02	BASIC ELECTRICAL ENGINEERING	Electrician	60
ECBT – 03	**BASIC ELECTRONICS	Electronic Mechanic or Mech. R&TV	60
ECBT – 04	**BASIC WIRING AND WINDING	Electrician	80
ECBT – 05	**BASIC POWER GENERATION, TRANSMISSION & DISTRIBUTION	Electrician	60
ECBT – 06	BASIC COMPUTERS OPERATING SKILL & ITS APPLICATION	COPA or IT&ESM	60

*Facilities available in ITIs may be utilized for imparting skill training. Where such trades are not in operation , facilities available in the near by ITI be utilized .

**Elementary topics relating to individual module if need be taught before starting the module .

For each of above module, Trade Practical will be 28 hours /week and Trade theory for 4 hours /week. Apart from above, Generic modules as mentioned below will be taught throughout the year.

ECBT-07- WORKSHOP CALCULATION & SCIENCE.....2 hrs/week

ECBT-08-ENGINEERING DRAWING2 hrs/week

G-01-ENTERPRENEURSHIP AND COMMUNICATION SKILLS...2 hrs/week

In addition, 4 hours/week have been kept for Library studies & Physical Training

Vocational Instructors:

NAME OF THE MODULE	No. of Vocational Instructors (VIs)
ECBT – 01 to 06	Six VIs one each for 6 module of relevant trades
ECBT-07 & ECBT - 08	One VI having Diploma in relevant field
G-01	One contract/part time / guest faculty for Generic module, ENTREPRENEURSHIP AND COMMUNICATION SKILLS –G-01

The eligibility and other criteria will be as follows:

Eligibility : 10th pass under 10+2 system with Science as one of the subject

Batch size : 96 trainees 16 in each module (20% supernumeraries be allowed to take care of drop outs as already exist under CTS)

Admission:

For basic training, admissions are to be made in August / Feb each year.

Fee Structure:

Fee Structure may be decided by States Govt. in consultation with IMCs . It may be desirable to prescribe a uniform tuition fee for a sector in all Centres of Excellence of a state.

Space:

Since workshop/theory class rooms are envisaged to be accommodated in the existing building of the ITI, therefore, following norms are prescribed only for new infrastructure is to be created .

- (1) Workshop space of 60 Sqm for each basic module (except for ECBT-1 & ECBT – 4 where space required is 80 Sqm)
- (2) Three Theory classrooms of 30 Sqm each
(some flexibility i.e. from 55 - 60 Sqm / 75-80 Sqm area for workshop and 20-30 Sq.m area for class room area is proposed to be provided)

The Theory classrooms should have latest infrastructure including AV aids as per details given below:

- | | |
|--|---------------|
| 1. Suitable Chairs/ tables* | -As required |
| 2. OHP/Epidiascope | - 1 No. |
| 3. Laptop computer/PC (latest) & LCD projector** | -1 No. |
| 4. Magnetic white board | -1 No. |
| 5. White board | -1 No. |
| 6. Flip chart | -1 No. |
| 7. Storage Almirah | - As required |

(* Optimum utilization of space/flexibility may be kept in view)

(**Keeping in view the constraints of funds under the scheme, it is proposed to procure only one set of Laptop computer/PC / LCD projector for CoE. However, States if so desire may procure additional Laptop computer/PC/LCD projector from their funds). While selecting furniture, it should be kept in mind that these are meant for Centres of Excellence. Criteria like maximum flexibility/utilization of space should be kept in view.

Office Equipment:

For each CoE one Scanner, one Photocopy Machine and one PC/printer along with suitable accessories/furniture and internet connection (if not already available in the institute) is proposed to be provided for each CoE, in addition to the equipment prescribed in the syllabus.

Addition/alteration/Construction:

For Civil Works, tentative amount of Rs 40.00 lakhs have been proposed per CoE. It is envisaged to have separate block/ wing for the Centres of Excellence in the ITI campus. In case space is available in the existing building of an ITI for taking up new areas as per requirement of the cluster of Industry, the existing space will be renovated as per the need. Alternately, separate block will be built up in the same campus keeping in view the space requirements of the Electrical Sector .

While planning for addition /alteration/Construction of workshop and Class rooms, following may be kept in view:

- ✓ concept of a Centre of Excellence
- ✓ the fact that the requirement of funds for construction /addition /alteration for advanced training will be higher than that of basic training

Publicity

Wide publicity & advertisement be given for better response . The role of the local as well as the concerned Industry is very vital for the success of this program.

States may consider providing additional equipment/ other facilities like separate Library/upgradation of existing Library, Conference Hall/ Committee Room etc. from their own funds.

I N D E X

UPGRADATION OF ITIs INTO CENTERS OF EXCELLENCE (CoE)

SECTOR / AREA : ELECTRICAL

BROAD BASED BASIC TRAINING

(ONE YEAR)

MODULE NO.	NAME OF THE MODULE	DURATION IN WEEKS	PAGE NO.
ECBT – 01	BASIC ENGINEERING SKILL	8 weeks	2 - 7
ECBT – 02	BASIC ELECTRICAL ENGINEERING	- do -	8 - 16
ECBT – 03	BASIC ELECTRONICS	- do -	17 - 23
ECBT – 04	BASIC ELECTRICAL WIRING AND WINDING	- do -	24 - 30
ECBT – 05	BASIC POWER GENERATION, TRANSMISSION & DISTRIBUTION	- do -	31 - 39
ECBT – 06	BASIC COMPUTER OPERATING SKILL & ITS APPLICATION	- do -	40 - 43

COMMON SUBJECTS			
ECBT – 07	WORKSHOP CALCULATION & SCIENCE	@ 2 hrs / week 48 weeks	44 - 46
ECBT – 08	ENGINEERING DRAWING	- do -	47 - 49
G - 01	ENTREPRENEURSHIP COMMUNICATION SKILLS AND (given separately)	- do -	--

UPGRADATION OF ITIs into CENTERS of
EXCELLENCE (CoE)

SECTOR / AREA: ELECTRICAL

BROAD BASED BASIC TRAINING – One Year

MODULE – ECBT - I: BASIC ENGINEERING SKILL

(Duration - **8 weeks**)

BROAD BASED BASIC TRAINING

(One Year)

MODULE – ECBT - I : BASIC ENGINEERING SKILL

(Duration - 8 weeks)

I) COURSE CONTENT

Practical	Theory
<p>Safety precautions in workshop, use of fire protection devices, First aid, List of safety equipments.</p> <p><u>CARPENTRY</u> Sawing and planing practice. Practice in using firmer chisel and preparing simple half lap joint.</p>	<p><u>CARPENTRY</u> Description of carpenter's common hand tools such as saw planes, chisels, mallet, claw hammer, marking, dividing and holding tools-their application, care and maintenance.</p>
<p><u>FITTING & DRILLING</u> Basic fitting operations like chiseling, filing, tapping, hacksawing, etc. Drilling practice in hand drilling & power drilling machines (bench & portable), Grinding of drill bits. Practice in using taps & dies, threading hexagonal and square nuts etc., cutting external threads on stud and on pipes riveting practice, making earthing plates, panel boards, etc.</p>	<p><u>FITTING & DRILLING</u> Introduction to Fitting, Description and use of files, hammers, chisels, hacksaw frames and blades-their specification and grades, Use of steel rule, try-square, vernier caliper & micrometer screw gauges. Making tools description and use, Types of drills, description of bench/portable drilling machines, proper use, care and maintenance. Various fitting operations (Drilling, filing, tapping, etc.) Description of taps & dies, types of rivets and riveted joints, Use of thread gauge.</p>
<p><u>SHEET METAL</u> Demonstration and practice of simple sheet metal work, cutting, bending, joining. Marking simple sheet metal articles.</p>	<p><u>SHEET METAL</u> Introduction to sheet metal worker's common hand tools, sheet and wire gauges, Pipe and pipe fittings, Non ferrous metal sheets (Copper, Aluminium & Brass, etc.)</p>

Practical	Theory
<p><u>SOLDERING & BRAZING</u></p> <p>Demonstration & Practice in using Trade hand tools. Different types of solder fluxes and their proper use. Introduction to the equipments used for soldering and crimping, Care & maintenance on Soldering & Crimping equipments, Soldering & Brazing practice</p> <p>Removing of insulations from assorted wires and cables. Joining practice with single and stranded conductors of different wires cables.</p>	<p><u>SOLDERING & BRAZING</u></p> <p>Description, specification, general use, care & maintenance of common hand tools.</p> <p>Soldering material, Flux and description of simple soldering and brazing common joints.</p> <p>Wires & Cables-Introduction, types, specifications (SWG & MM Square) & Use.</p>
<p><u>PLUMBING</u></p> <p>Cutting of conduit pipe, threading, making of different type of square and rectangle.</p>	<p><u>PLUMBING</u></p> <p>Cutting, threading & fixing of conduit accessories and installation.</p>

Terminal Objective: -

After completion, the participants will be able to:

- ✓ use different type of tools used for carpentry, fitting, drilling, and plumbing etc.
- ✓ perform soldering & brazing, etc.
- ✓ make sample sheet metal articles.
- ✓ cut conduit pipe and make threading on it.

II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees

Sl. No.	Items	Qty.
1.	Measuring Tape Steel 100cm	17 Nos.
2.	Rule Steel 300mm	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 peen 0.75kg with handle	17 Nos.
11.	Hammer cross peen 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.
18.	Voltage sensor (pencil type)	17 Nos.
19.	Screw Driver Kit (Set of six blades with common insulated handle with neon tester)	17 Nos.
20.	Plier insulated 150 mm	17 Nos.
21.	Multimeter	17 Nos.
22.	Soldering iron, 25W, 230 V	17 Nos.

General Tools & Equipment for Workshop

Sl. No.	Item	Quantity
1.	Try square 150 mm	17 Nos.
2.	Plier round nose 100 mm	17 Nos.
3.	Plier flat nose 150 mm	17 Nos.
4.	Tweezer 100 mm	17 Nos.
5.	Soldering Iron 25 Watt/65 watt	17 Nos. each
6.	DeSoldering Pump	8 Nos.
7.	Soldering gun/Desoldering Gun	4 Nos. each
8.	Soldering pot	2 Nos.
9.	Blow lamp 0.12 litre capacity.	4 Nos.
10.	Spanner Kit (Double Ended).	2 Nos.
11.	Drill machine hand 0 to 6mm capacity	10 Nos.
12.	Drill machine electric portable 0 to 6mm capacity	4 Nos.
13.	Drill machine pillar 0 to 12mm capacity	2 Nos.
14.	Mallet hard wood 0.5 Kg.	17 Nos.
15.	Hammer plastic	17 Nos.
16.	Oil cane 1/2 litre	17 Nos.
17.	Allen Key	17 Nos.
18.	Scissor 150 mm.	10 Nos.
19.	Plain smooth.	10 Nos.
20.	Grease Gun (medium size)	4 Nos.
21.	Grease Gun (small size)	4 Nos.
22.	Hacksaw frame 150 mm.	17 Nos.
23.	Hacksaw frame 200 mm	17 Nos.
24.	Snip straight 150 mm	10 Nos.
25.	Snip curved 150 mm	10 Nos.
26.	Spanner single ended 6 mm – 25 mm	2 Sets.
27.	Spanner double ended 6 mm – 19 mm	2 Sets.
28.	Drill SS twist block 2 mm – 12 mm	4 Sets.
29.	File flat 200 mm 2 nd cut	17 Nos.
30.	File flat 200 mm bustard	17 Nos.
31.	File flat 200 mm smooth	17 Nos.
32.	File flat 150 mm 2 nd cut	17 Nos.
33.	File flat 150 mm bastard	17 Nos.
34.	File round 200 mm bastard.	17 Nos.
35.	File round 200 mm.	17 Nos.
36.	File flat 150 mm smooth.	17 Nos.
37.	Instrument file (set of 12)	10 Nos.
38.	Bench vice 100 mm jaw.	17 Nos.
39.	Tap set 3 mm- 10 mm (set of 9).	4 Nos.
40.	Die set 3 mm- 10 mm (set of 9).	4 Nos.
41.	Vice hand 50mm jaw	10 Nos.
42.	De-soldering gun.	4 Nos.
43.	'C' clamp 200mm, 150mm, & 100mm	4 Nos.
44.	Hammer Ball pien 0.450 kg.	17 Nos.
45.	Hammer Cross pien 0.255 kg.	17 Nos.
46.	Micrometer outside 0-25mm (Analog & Digital)	4 Nos. each.
47.	Stock and die conduit (for 1" to 2 x 1/4")	2 Nos.

48.	Pipe vice	2 Nos.
49.	Pipe cutter up to 5 cm dia.	2 Nos.
50.	Fire extinguisher.	4 Nos.
51.	Fire Bucket	1 No.
52.	Vernier caliper	2 Nos.

Sl.No.	Workshop Furniture	Qty.
1	Instructor table & chair	1 each
2	Suitable work tables with Vices	As required
4	Revolving Stool cum chair	16 nos
5	Green Glass Board	1 no.
6	Metal Rack	As required
7	Locker with 8 drawers (standard size)	2 nos.
8	Storage Almirah	As required
9	Book shelf (Glass panel)	1 no.
10	Fire fighting equipment, first aid box etc.	As required

UPGRADATION OF ITIs into CENTERS of
EXCELLENCE (CoE)

SECTOR / AREA: ELECTRICAL

BROAD BASED BASIC TRAINING
(One Year)

MODULE – ECBT -2: BASIC ELECTRICAL ENGINEERING
(Duration - 8 weeks)

BROAD BASED BASIC TRAINING

(One Year)

MODULE – ECBT - 2 : BASIC ELECTRICAL ENGINEERING

(Duration - 8 weeks)

I) COURSE CONTENT

Practical	Theory
<p>Familiarization with shop layout, hand tools & machines Safety Precautions, including use of fire-fighting equipment, Elementary first aid, and treatment for electric shocks.</p> <p>Skinning the Cable, installation of Aluminum conductor cable and copper conductor. Joining practice with Single Strand Conductor and Multi Strand Cables and joints of bare conductors such as Britannia, straight, western union, Tee etc.</p> <p>Soldering practice on joints of wires. Soldering Copper Aluminum lugs with wire/cable ends., crimping joints of wires and cables, Crimping lugs with wire/cable ends. Fixing and Connections to common electrical accessories e.g. switches, plug, sockets Holders, fuses, M.C.B. etc.</p>	<p>Types, grades, shapes and sizes of insulated wires and cables, their proper selection and use. Different type of joints e.g. Britannia, Straight, Tee, Western union.</p> <p>Care in making a good joint on aluminum wires and cables.</p> <p>Letters signs and symbols used in Electrical Technology.</p>
<p>Identification of AC & DC supply. Measurement of voltage, current, power and energy on A.C. and D.C. using Voltmeter, Ammeters, Watt meters and Energy meter. Verification of Ohm's Law.</p> <p>Measurement of resistance by Ohm meter, multimeter etc. Practice in using shunts and Multipliers, Determination of specific resistance. Selection of resistors for various applications.</p> <p>Wiring for a simple circuit in metal conduit and P.V.C. Conduit in accordance to I.E. rules and I.S.</p> <p>Measurement of Earth Resistance.</p> <p>To check a capacitor and determine its capacity.</p>	<p>Ohm's Law & its application, Concept of Electrical Circuit e.g. Series, Parallel and Mixed Circuits. Identification of AC & DC Meters.</p> <p>Resistance and laws of resistance. Problems on laws of resistance, Kirchhoff laws and their application. Wheat stone bridge and its application.</p> <p>Testing of wiring installations, Common faults their causes & remedies.</p> <p>Earthing and its Purpose and Types. I.E. rules regarding Earth and Earth resistance.</p> <p>Measurement of earth resistance by use of Megger.</p>

Preparation of Electrolyte, charging batteries checking accumulators for charge and discharge conditions, Determination of internal resistance of any cells of accumulator.	Electrolysis, Primary and Secondary cells, Dry cell. Standard cell. Grouping of cells. Construction & working of lead acid and alkaline accumulators, Common defects in accumulators their causes, indication and remedies. Battery charging.
Making a simple electromagnet, studying its field strength by varying Ampere-Turns Finding the Permeability of iron, study Connections and testing of electric bell/Buzzer/Door chime and its connections with bell indicator. Study the construction and operation of an electromagnetic over-load relay.	Magnets, their types, shapes, properties, B-H curve, methods of magnetization and demagnetisation. Electromagnets, their advantages over Permanent magnets, Solenoids. Electromagnetic induction (Self & Mutual) Faradays Laws of Electromagnetic induction Lenz's law , eddy currents.
Measurement of Power and Power factor in A.C. Circuits, Determination of Inductance Capacitance and Impedance by Inductance Bridge, Capacitance Bridge and Impedance Bridge respectively. Practicals on simple R, L & C series & parallel circuits	Capacitor, working & types. Capacity of capacitor and Energy stored in capacitor. Electrical terms normally used in A.C. e.g. R.M.S. Value, Maximum value, Average value, Inductance, Capacitance, Impedance, and Reactance. Power and Power Factor in A.C. Disadvantages of poor P.F. and methods of improvement. Simple A.C. circuits, single phase & three phase.
Identify the HT & LT winding of transformer. Verify its transformation ratio. Determine the magnetization curve of transformer. To determine the Iron loss and copper loss in transformer.	Transformer, working principle, types as per core, single phase and three phase, parts of power transformer. Voltage transformation ratio of transformer. Cooling of transformer. Different methods used for cooling. Parallel operation of transformer, Losses in transformer, Copper loss, Losses due to hysteresis & eddy current.
Connections and testing of contactors and alarm circuits	Illumination terminology, laws of illumination Types, Construction & working of incandescent lamps Principal of discharge lamps, construction, working & use of Fluorescent lamps Mercury vapour lamp sodium vapour lamps and Neon signs.

Connections & testing of Fluorescent lamp, Mercury Vapour lamp and sodium vapour lamps and their accessories. Twin method of Fluorescent lamps connections. Drawing various electrical symbols used in the Circuitry.	Study of simple contactors and alarm circuits.
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Terminal Objective:

After completion the participants will be able to:

- ✓ Wire & test simple electrical circuits, in different types of wirings with suitable controlling & protective devices, observing I-S Standards & I.E rules.
- ✓ Define & measure electrical quantities like voltage current resistance power & energy using appropriate & different instruments like voltmeters, ammeters, multimeter , watt meters, etc.
- ✓ Test wiring installation for insulation resistance faults-using appropriate instruments & rectify faults.
- ✓ Test, charge & do outline maintenance of different types of batteries.
- ✓ Define, Magnetism, Electromagnetism, and magnetic field etc.
- ✓ Check a capacitor and identify the HT & LT winding of transformer and able to find output of transformer.
- ✓ Testing of contactors & alarm circuits.

II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees

Sl. No.	Item	Qty.
1.	Measuring Tape Steel 100cm	17 Nos.
2.	Rule Steel 300mm	17Nos.
3.	Screw Driver heavy duty 200mm insulated thick stem	17Nos.
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 peen 0.75kg with handle	17Nos.
11.	Hammer cross peen 115gms with handle	17Nos.
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	17 Nos
18.	Screw Driver Kit (Set of six blades with common insulated handle with neon tester)	17 Nos
19.		17 Nos
20.	Plier insulated 150 mm	17 Nos.
21.	Multimeter	17 Nos.
22.	Soldering iron, 25W, 230 V	17 Nos.

General Tools & Equipment for Workshop

Sl. No.	Items	Qty.
1.	Screw Driver 100 mm with handle	10 Nos.
2.	Screw Driver 150 mm with insulated handle	10 Nos.
3.	Plier Gas 200 mm	10 Nos.
4.	Plier round nose 100 mm	10 Nos.
5.	Plier flat nose 150 mm	10 Nos.
6.	Side cutting plier 150mm.	10 Nos.
7.	Tweezer 100 mm	10 Nos.
8.	Scissor blade 150 mm	2 Nos.
9.	Blow lamp 1 pint capacity	5Nos.
10.	Melting pot	2 Nos.
11.	Soldering iron 65 watt ,125 watt, 250 watt	8 Nos. each
12.	Soldering gun/Desoldering gun	2 Nos.
13.	Chisel wood firmer 25 mm x 6mm	10 Nos.
14.	Chisel wood firmer 19 mm x 6 mm	10 Nos.
15.	Mallet hard wood 0.5 Kg.	10 Nos.

16.	Hammer hard plastic with handle	10 Nos.
17.	Spanner 150mm adjustable as clay burns	2 No.
18.	Drill machine hand 0 to 6mm capacity	10 Nos.
19.	Drill machine electric portable 0 to 6mm capacity	2 Nos.
20.	Drill machine pillar 0 to 12mm capacity	1 No.
21.	Allen Key	2 set.
22.	Oil cane 1/2 litre	4 Nos.
23.	Grease gun	2 Nos.
24.	Micrometer outside 0-25mm (Analog & Digital)	2 Nos.each
25.	Grinder Bench Motorised	1 No.
26.	Rawl plug tool and Bit	5 Nos.
27.	Hacksaw frame 300mm, 200mm	5 Nos each.
28.	Try square 150mm blade	10 Nos.
29.	Plum bob (Brass)	10 Nos
30.	Snip straight 200mm	5 Nos.
31.	Snip curved 150mm	5 Nos.
32.	Gauge wire (Imperial)	4 Nos.
33.	File flat 200mm 2 nd cut	8 Nos.
34.	File flat 250mm Bastard	8 Nos.
35.	File flat 250mm smooth	8 Nos.
36.	File round 200mm 2 nd cut	4 Nos.
37.	File half round 2 nd cut 200mm.	4 Nos.
38.	File round 100mm 2 nd cut	4 Nos.
39.	File triangular 150mm	4 Nos.
40.	File flat 150mm rough	4 Nos.
41.	File Rasp, Half round 200mm Bastard	8 Nos.
42.	Vice hand 50mm jaw	8 Nos.
43.	Stock and die conduit (for 1" to 2x1/4")	2 Nos.
44.	Vice table 150 mm jaw	5 Nos.
45.	Vice Pipe	2 Nos.
46.	Multimeter (Digital)	4 Nos.
47.	Ammeter MC 0 – 500 mA	2 Nos.
48.	Ammeter 0 –1 A	2 Nos.
49.	Ammeter M I , 0 – 1 A	4 Nos.
50.	Power factor meter single phase	2 Nos.
51.	Power factor meter three phase	1 No.
52.	Energy meter 1KW DC	2 Nos.
53.	Tong tester (0 to 25 A, 0 – 50 A multi range)	1 No .each
54.	Milli voltmeter center zero (100 – 0 – 100 mV)	1 No.
55.	Ammeter MC 0 – 25 A	2 Nos.
56.	Ammeter MC 0 – 5 – 10 – 15 A	2 Nos.
57.	Ammeter AC 0 – 25 A	2 Nos.
58.	Ammeter AC 0 – 5 – 10 – 15 A	2 Nos.
59.	Voltmeter DC 0 – 150 – 300 – 600 V	2 Nos.
60.	Voltmeter AC 0 – 150 – 300 – 600 range	2 Nos.
61.	Wheat stone Bridge (complete with galvanometer and Battery)	1 No.
62.	Meggar 500 ohm	2 Nos.
63.	Earth fault locator	1 No.
64.	Energy meter AC 5A 250V (Induction Type)	2 Nos.

65.	Energy meter 3 phase 4 wire 5 A (Induction Type)	2 Nos.
66.	Watt meter single phase 1 KW	1 No.
67.	Watt meter 3 phase 2 element 5A	2 Nos.
68.	Crimping tool	2 Nos.
69.	B A taps and dies 0 – 2 – 4 – 6 – 8 sizes	2 set
70.	Pipe cutter	2 Nos.
71.	Desoldering pump.	4 Nos.
73.	VAR meter 1 KVAR	1 No.
74.	Laboratory type induction coil 6V to 800 – 10000V	1 No.
	Magnetic flux meter	
75.	Fixed resistance 5 Ω 20 watt	2 Nos.
76.	Fixed resistance 10 Ω 20 watt	2 Nos.
77.	Fixed resistance 50 Ω 25 watt	2 Nos.
78.	Fixed resistance 100 Ω 100 watt	2 Nos.
79.	Fixed resistance 100 Ω 200 watt	2 Nos.
80.	Fixed resistance 500 Ω 200 watt	2 Nos.
81.	Fixed resistance 1000 Ω 200 watt	2 Nos.
82.	Rheostat 84 Ω 3. 5 watt	2 Nos.
83.	Rheostat 280 Ω 3.5 watt	2 Nos
84.	Watt meter single phase, single element (Flush	2 Nos
85.	mounting type) multi Range: 0-750-1500 Watt. rectangular shape.	16 Nos.
	Ammeter MI type, Rectangular shape, flush	
86.	mounting,size106x84mm, multi range, 0-5-10 A.	16 Nos.
	Voltmeter MC type AC, Rectangular shape, flush	
87.	mounting, size 106x 84mm, multi range, 0-150-300 V.	16 Nos.
88.	Auto Transformer, continuous variation, single phase, flush mounting type, 0- 270 V, 5 A.	16 Nos.
89.	Transformer single phase 1KVA 230/ 115V 50 Hz core type, air cooled	6 Nos.
90.	Transformer three phase 2.5 KVA 400/ 230V 50 Hz delta and star oil cooled	4 Nos.
91.	Current transformer	2 Nos
92.	Potential Transformer	2 Nos.
93.	Variable auto transformer 0 – 270V 5A -10A single phase	2 Nos each
94.	Variable auto transformer 0 –440V 3 phase 5-10A	2 Nos. each
95.	U shape /Bar magnet	As reqd.

Sl.No.	Workshop Furniture	Qty.
1	Instructor table & chair	1 each
2	Suitable work tables with Vices	As required
3	Suitable Table Teak Wood fitted with Back Panel complete with different types of meters/switches, AC/DC supplies etc. required for testing of electronic circuits. Insulation mats to cover below the table.	As required
4	Revolving Stool cum chair	16 nos
5	Green Glass Board	1 no.

6	Metal Rack	As required
7	Locker with 8 drawers (standard size)	2 nos.
8	Storage Almirah	As required
9	Book shelf (Glass panel)	1 no.
10	Fire fighting equipment, first aid box etc.	As required

UPGRADATION OF ITIs into CENTERS of
EXCELLENCE (CoE)

SECTOR / AREA: ELECTRICAL

BROAD BASED BASIC TRAINING
(OneYear)

MODULE – ECBT - 3: BASIC ELECTRONICS
(Duration - 8 weeks)

BROAD BASED BASIC TRAINING
(One Year)

MODULE – ECBT - 3: BASIC ELECTRONICS

(Duration - 8 weeks)

I) COURSE CONTENT

Practical	Theory
Tool Identification, safety precautions, Familiarization with Electronic Components. Different Type of Soldering Iron. Use of Soldering Iron. Color Code of Fixed Resistors.	Knowledge of tools used in Electronics Lab. Safety precaution in Electronics Lab. Soldering Process. Flux. Basic Electronic Components.
Use of various Meters for Measuring Voltage, Current , Resistance etc. Safe Handling of Instruments . Use of Digital & Analog Multimeter. Familiarization with CRO. Measurement of L, C and R using LCR bridge.	Passive Components: Resistor, Capacitors & Inductor, Moving coil & Moving Iron meter. Working principle of analog Multimeters. Introduction to surface mounting devices.
Identification & Testing of various types of Diodes. Familiarization with CRO, Operating knobs. Construction of Half Wave & Full Wave Rectifiers. Calculation of Ripple using Filters to improve DC Output.	Conductor, Insulator and Semi Conductor. P Type and N-Type semi conductors. P-N Junction, Diode Construction, V-I Characteristics, Forward and Reverse Bias, Half Wave , Full wave rectification using Centre tap transformer and Bridge Rectifier. Filter Circuit. Regulator, Zener Diode. Varactor, PIN, Tunnel Diode, LED, LDR, IRED, LCD, etc.
Transistor Testing, study the transistor characteristics. Construction of single stage amplifier. Construction of a transistor- switch and to drive a relay.	Transistor- Construction, Working and Configuration, Symbols. Input & Output Characteristics of Common Base, Common Emitter and Common Collector Configuration, Biasing of Transistors. Small Signal & Multi Stage Amplifier- RC Couple, Direct Couple and Transformer Coupled Amplifier. Concept of Negative & Positive Feedback.
Construction of RC Phase Shift Oscillator. Construction of Astable and Bistable multivibrator.	Oscillator & Multi vibrators. : RC & LC Oscillators. Astable & Bistable Multivibrator using transistor Circuit.
Plotting of V-I Characteristics of SCR/Triac, study of light Dimmer.	SCR Construction, UJT, Power MOSFET, TRIAC, DIAC- Construction and Working.

Lab Demonstration of all types of Digital Logic Gates.	Digital Electronics- Introduction, Number System, Binary to decimal conversion and vice versa. Digital Logic Gates, Op Amps applications, IC 555.
Verification of all truth table.	Introduction to assembly of different types of ICs used in Electronics circuits.
Familiarization with various IC and their Packages.	Concept of static charge

Terminal Objective :

After completion the participants will be able to :

- ✓ use the hand tools correctly & safely
- ✓ use wire gauge, feeler gauge, read colour code of resistors etc. capacitors, verify ohms law, series, parallel connections etc.
- ✓ use voltmeter, ammeter, ohm meter & multimeter correctly, observing safety precautions in handling them.
- ✓ use of Wheat-stone bridge, LCR bridge to measure L C & R
- ✓ solder wires on PCB, using proper soldering iron of different wattages correctly.
- ✓ identify & test hf, af coils, wind small coils & test them
- ✓ Read data book for semiconductors, connect them properly in circuits, plot characteristics.
- ✓ Use of oscilloscope, signal generator, transistor tester etc..
- ✓ Trace circuit diagrams & interpret circuit diagrams.

II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees

SL. NO.	Item	Qty.
(A) TOOLS KIT		
1	Screw driver 15 cm	17 nos.
2	Hammer cross peen 110 gm with handle	17 nos.
3	Steel rule 300mm	17 nos.
4	Long nose plier 15cm insulated	17 nos.
5	Diagonal cutter 15 cm insulated	17 nos.
6	Screw driver 20cm X 9mm Blade	17 nos.
7	Tweezer	17 nos.
8	Watch makers Screw Drivers set	17 nos.
9	Pliers combination 150 mm.	17 nos.
10	Neon Tester Pen type	17 nos.
11	Wire Stripper	17 nos.
12	Soldering Iron 25 Watt	17 nos.
13	Soldering Iron 65 watt, Pencil bit	17 nos.
14	Knife Electrician Double bladed	17 nos.
15	Philips Screw Driver Type (set of 5 pieces)	17 nos.
16	Digital Multimeter	17 nos.
17	Heat Sink Plier	17 nos.
18	Pincer	17 nos.
19	Scriber 150 mm	17 nos.
20	Center Punch 100 mm	17 nos.
21	Voltage Sensor (Pencil type)/Electronic Tester	17 nos.
22	Tool Box/Bag	17 nos.
General Tools & Equipment for Workshop		
23	Drilling machine bench up to 12mm dia (with polishing, buffing accessories)	1 no.
24	Portable electric drill 10mm	2 nos.
25	Vacuum Cleaner	1 no.
26	Screw Driver 100 mm	4 nos.
27	Plier Insulated 200mm	4 nos.
28	Plier round	04 nos.
29	Oil Cane 250 ml	2 nos.
30	Grease Gun	1 no.
31	Hammer Hard Plastic	2 nos.
32	Hammer Bal Pein 0.4 Kg	2 nos.
33	Hacksaw Frame 300 mm	4 nos.
34	Hacksaw Frame 200mm	2 nos.
35	Snip Straight 150mm	4 nos.
36	Drill Twist block (2-8mm)	1 set
37	File Flat 200 mm smooth	4 nos.
38	File round 200 mm 2 nd cut	4 nos.

39	File half round 250 mm	4 nos.
40	File Triangular 150 mm	2 nos
41	Instrument files set of 12	4 nos.
42	Taps set 2-10mm with handle set of 9	2 nos.
43	Die set 2-10mm with handle set of 9	2 nos.
44	Crimping tool	8 nos.
45	Wire guage	1 no.
46	Feeler guage	4 nos.
47	Pipe cutter to cut 5 cm dia	2 nos.
48	Grinder Bench Motorised	1 no.
49	Allen Key set	4 nos.
50	Spanner double ended set of 12 metric sizes 6 to 32 mm.	4 Sets
51	Spanner, adjustable 15cm.	4 No.
52	Vice Bench 5 cm jaw	2 nos
53	Vice bench 10 cm jaw	2 nos
54	Soldering Iron 250 watt	1 no.
55	Soldering station	2 nos
56	Desoldering station	2 nos.
57	Desoldering pump	6 nos.
58	Melting pot	4 nos
59	Soldering iron 25 W/6 volts	4 nos.
60	Power Supplies 0-6 volts/1 A	8 nos.
61	Power Supplies 0-12 volts/1 A	8 nos
62	Power Supplies 0-30 volts/2 A	8 nos.
63	Rheostats of various values & ratings	10 nos
64	DC & AC Ammetr 0-50 micro A	4 nos. each
65	-do- 0-10 ma, 100ma, 600ma	4 nos. each
66	Motwane Multimeter (Big) with AC current, high voltage test probes	1 no.
67	Analog multimeters	8 nos.
68	DC & AC Voltmeter 0-12 volt	8nos. each
69	DC & AC Voltmeter 0-50 volt	8 nos.each
70	DC & AC Voltmeter 0-500 volt	8nos each
71	Watt meter 0-1000 W	2 nos
72	AF Oscillators	4 nos.
73	RF Oscillators	4 nos.
74	Signal Generator	4 nos.
75	CRO single beam	2 nos.
76	CRO dual trace/double beam 20 MHz	2 nos.
77	Ohm meter	4 nos.
78	LCR Bridge	8 nos.
79	Transistor Tester	2 nos.
80	Universal IC Tester	2 nos.

	Workshop Furniture	Qty.
1	Instructor table & chair	1 each
2	Suitable work tables with Vices	As required
3	Suitable Table Teak Wood fitted with Back Panel complete with different types of meters/switches, AC/DC supplies etc. required for testing of electronic circuits. Insulation mats to cover below the table.	As required
4	Revolving Stool cum chair	16 nos
5	Green Glass Board	1 no.
6	Metal Rack	As required
7	Locker with 8 drawers (standard size)	2 nos.
8	Storage Almirah	As required
9	Book shelf (Glass panel)	1 no.
10	Fire fighting equipment, first aid box etc.	As required

UPGRADATION OF ITIs into CENTERS of
EXCELLENCE (CoE)

SECTOR / AREA: ELECTRICAL

BROAD BASED BASIC TRAINING

(One Year)

**MODULE – ECBT - 4: BASIC ELECTRICAL WIRING AND
WINDING**

(Duration - 8 weeks)

BROAD BASED BASIC TRAINING

(One Year)

MODULE – ECBT - 4: BASIC ELECTRICAL WIRING AND WINDING

(Duration - 8 weeks)

I) COURSE CONTENT

Practical	Theory
Identification of different wiring materials their specifications. Practice in fixing and connecting wiring accessories such as switches, plugs, lamp holders.	Introduction and explanation of electrical wiring systems, I.E. Rules for different wiring system – both domestic as well as industrial. Basic requirement of Electrical installation i.e. Safety, Conductor Voltage Drop, Life expectancy, Economy etc.
Lay out marking on wiring boards (a) one lamp control by one S.P. switch (b) Two lamp control by two independent switches. (c) one lamp controlled by two way switches. Wooden battens practice through simple circuits.	Explanation of circuits branching max. load/ckt/ way as per rules. Wiring material used for PVC cables, I.E. Rules, Indian standards regarding the above wiring such as – clip distance fixing of screws, cable bending etc. Casing & Capping wiring material & different available sizes. Different type of Circuits commonly used in Wiring systems.
Practice in P.V.C. insulated cable wiring on wood battons with distribution board and Number of circuits. One lamp control from three different locations. Practice of wiring in conduit, using metal clad 3-pin plug, earthing the conduit using the earth clips and earth wire. Practice in conduit wiring industrial power wiring to wire a single-phase motor with switch & starter.	Conduit pipe wiring materials and accessories, types and sizes of conduit. I.E. Rules for earthing conduits using earth clip and earth wire – IS 732- 1963.
Demonstration and practice of multistoried building wiring layout.	Wiring workshop, factories and houses. Their special precautions as per I.E. Rules. Knowledge of fire Insurance rules and its applications.

Domestic wiring installations for mixed load, both light and power & Installing Energy meter.	<p>Explanation and lay out of wiring for Multi-Storied Buildings as per I.E. Rules.</p> <p>Explanation of inter connection wiring circuits in the main building and auxiliary blocks, Meter boards and its locations.</p> <p>Study of lay out symbols in the preparation of layout diagrams.</p>
Trouble shooting of different types of wiring.	Causes & Remedies for faults in different wiring system .
Wiring of the Low Power A.C./D.C. Machines in metal conduit systems as per I.E. Rules and wiring their panels.	<p>Working principal and applications of Different types of DC motors and their controls. Different types of variable speed AC motors and their controls.</p> <p>Different types of motors used in industries ie. Squirrel cage Induction Motor, Slip ring Induction motor, Single phase Induction Motor, their classification according to the environment & cooling methods. Motor Size, Selection of speed & their normal method of wiring, breaking with AC/DC etc., Their connections lay out and earthing. Code practice for earthing of Industrial wiring. Application of 3-point, 4-point star delta starters.</p>
Testing of different wiring installations by megger. Insulation tester, earth continuity test.	<p>Explanation of Megger & types, use of megger in fault location in wiring system.</p> <p>Explanation of wiring and earthing of different domestic appliances.</p>
Simple rewinding for fans and F.H.P. motors.	Simple rewinding procedure of fans and F.H.P. motors as per I.E. Rules.
Fault location and remedies practice both in domestic and industrial wirings.	Common faults , causes and remedies in domestic and industrial wiring installations . Methods of locating faults.
Demonstration and practice on telephone cable wiring and shielding of cables	Explanation of different telephone cables with specifications. Procedure for shielding telephone wiring
Winding of a small transformer.	Introduction to A.C. & D.C. windings used in various electrical appliances

Terminal Objective

After completion the participants will be able to :

- ✓ understand different types of wiring, i.e. rules
- ✓ understand different types of cables joints, soldering ,etc
- ✓ testing and installation for motors.
- ✓ understand the procedure of batten wiring system.
- ✓ understand the procedure of casing capping wiring system.
- ✓ understand the procedure of conduit pipe wiring system for domestic & industrial.
- ✓ understand the procedure of fault tracing in various wiring system.
- ✓ re-wind a transformer/simple motor of small size.
- ✓ Understand different types of a.c. / d.c. windings of motors & transformers.

II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees

Sl. No.	Name of Items	Qty. Required
1.	Measuring Tape Steel 100cm	17 Nos.
2.	Rule Steel 300mm	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 peen 0.75kg with handle	17 Nos.
11.	Hammer cross peen 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.	Tool Bag / Box	17 Nos.
18.	Rubber Gloves	17 Nos.
19.	Voltage sensor (pencil type)/ Electronic Tester	17 Nos.
20.	Screw Driver Kit (Set of six blades with common insulated handle with neon tester)	17 Nos.
21.	Plier insulated 150 mm	17 Nos.
22.	Digital Multimeter	17 Nos.
23	Soldering iron, 25W 230 V	17 Nos.

List of Tools & Equipments for module EBT-05

Sl. No.	Name of Items	Quantity
1.	Screw Driver 100 mm with handle	4 Nos.
2.	Screw driver kit (set of six blades with common insulated handle)	4 Nos.
3.	Screw Driver 150 mm with insulated handle	4 Nos.
4.	Plier insulated 200 mm	4Nos.
5.	Plier round nose 100 mm	4 Nos.
6.	Plier flat nose 150 mm	4 Nos.
7.	Tweezer 100 mm	4 Nos.
8.	Scissor blade 150 mm	2 Nos.
9.	Wire stripper 200 mm	4 No.
10.	Soldering iron 25 watt , 65 watt	2 Nos. each.
11.	Desoldering pump.	4 Nos.
12.	Soldering gun/Desoldering gun	2 Nos.
13.	Soldering iron 250 watts.	4 Nos.
14.	Drill machine hand 0 to 6mm capacity	4 Nos.
15.	Drill machine electric portable 0 to 6mm capacity	1 No.
16.	Drill machine electric portable 0 to 12mm capacity	1 No.
17.	Drill machine electric portable 0 to 12mm capacity	1 No.
18.	Drill machine pillar 0 to 12 mm capacity	2 set.
19.	Allen Key	2 Nos.
20.	Oil cane 1/2 litre	4 Nos.
21.	Grease gun	1 No.
22.	Grinder Bench Motorised	1 No.
23.	Pulley puller	1 Set
24.	Bearing puller	2 Nos. each.
25.	Rawl plug tool and Bit	4 Nos.
26.	Hacksaw frame 300mm, 200mm	4 Nos.
27.	Try square 150mm blade	4 Nos.
28.	Plum bob (Brass)	4 Nos.
29.	Snip straight 150mm	2 sets.
30.	Snip curved 150mm	
31.	Drill SS twist block	2 sets.
32.	(3mm,5mm,6mm,8mm,10mm, 12mm)Set of seven	4 Nos.
33.	Drill SS carbide Bit (4mm,5mm,6mm)Set of three	4 Nos.
34.	Plain smooth cutter 50mm	4 Nos.
35.	Gauge wire (Imperial)	4 Nos.
36.	File flat 200mm 2 nd cut	4 Nos.
37.	File flat 250mm smooth	2 Nos.
38.	File round 200mm 2 nd cut	4 Nos.
39.	File half round 2 nd cut 200mm.	4 Nos.
40.		
41.		

42.	File round 100mm 2 nd cut	1 No.
43.	File triangular 150mm	4 Nos.
44.	File Rasp, Half round 200mm Bastard	1 No.
45.	Vice hand 50mm jaw	2 Nos.
46.	Stock and die conduit (for 1"to 2 x 1/4")	2 Nos.
47.	Vice table 150 mm jaw	1 No.
48.	Vice Pipe table.	2 Nos. each.
49.	Crimping tool	2 Nos.
50.	Pipe cutter to cut 5cm dia.	2 Nos.
51.	Winding gun	2 Nos.
52.	Micrometer (analog & digital)	2 Nos.
53.	Multimeter digital	2 No.
54.	Ammeter MI, 0 –1 A .	2 Nos.
55.	Ammeter AC, 0 – 5 – 10 – 15 A	1 No.
56.	Tong tester (0 to 25 A, 0 – 50 A multi range)	4 Nos.
57.	Tong tester (0 to 50 A, 0 – 100 A multi range)	1 No.
58.	Ammeter AC 0 – 25 A	1 No. each
59.	Ammeter DC 0 – 5 – 10 – 15 A multi range	1 No.
60.	Voltmeter AC 0 – 150 – 300 – 600 V	2 Nos.
61.	Voltmeter DC 0 – 150 – 300 – 600 range	2 Nos.
62.	Megger 500 V, 1000V (Hand/motorized)	1 No.
63.	Earth fault locator	2 Nos.
64.	Watt meter single phase 3 KW	4 Nos.
65.	Watt meter 3 phase 2 element 3/5KW	8 Nos.
	Varnish baking oven	
	Fire extinguisher	
66.	Fire buckets	8 Nos.
67.	Watt meter single phase, single element (Flush mounting type) multi Range: 0-750-1500 Watt. rectangular shape.	8 Nos.
68.	Ammeter MI type, Rectangular shape, flush mounting,size106x84mm, multi range, 0-5-10 A.	8 Nos.
69.	Voltmeter MC type AC, Rectangular shape,	2 Nos.
70.	flush mounting,size106x 84mm, multi range,0-	2 Nos.
71.	150-300 V.	2 Nos.
72.	Auto Transformer, continuous variation, single	2 Nos.
73.	phase, flush mounting type, 0- 270 V, 5 A.	2 Nos.
	DC compound motor	
	1-phase a.c. motor (Capacitor start cap. Run)	
	Stepper motor	
	3-phase induction motor (slip ring) 3hp	
	3-phase induction motor (squirrel cage) 3hp	

Sl.No.	Workshop Furniture	Qty.
1	Instructor table & chair	1 each
2	Suitable work tables with Vices	As required
3	Table teak wood for Electrical Lab (with drawers) fitted with panel board with AC/DC power supply, ammeter, voltmeter, frequency meter, pf meter, dimmerstat etc. Insulation mats to cover below the table.	As required
4	Revolving Stool cum chair	16 nos.
5	Green Glass Board	1 no.
6	Metal Rack	As required
7	Locker with 8 drawers (standard size)	2 nos.
8	Storage Almirah	As required
9	Book shelf (Glass panel)	1 no.
10	Fire fighting equipment, first aid box etc.	As required

UPGRADATION OF ITIs into CENTERS of EXCELLENCE (CoE)

SECTOR / AREA: ELECTRICAL

BROAD BASED BASIC TRAINING

(One Year)

MODULE – ECBT - 5: POWER GENERATION, TRANSMISSION & DISTRIBUTION

(Duration - 8 weeks)

BROAD BASED BASIC TRAINING

(One Year)

MODULE – ECBT - 5: POWER GENERATION, TRANSMISSION & DISTRIBUTION

(Duration - 8 weeks)

I) COURSE CONTENT

Practical	Theory
<p>To study the Hydroelectric power system of generation.</p> <p>Study the Thermal power system of generation.</p>	<p>POWER GENERATION:</p> <p>Introduction:</p> <p>Importance of electrical energy. Generation sources of energy, Comparison of energy resources, Units of energy, Relationship among electrical energy, mechanical, electrical & heat energy. value of fuels. Types of fuels. Advantages of liquid fuel & solid fuel.</p> <p>Power Generation:</p> <p>Various ways of electrical power generation.</p> <ul style="list-style-type: none">• Thermal• Hydro electric• Nuclear• Non-Conventional <p>Thermal</p> <p>Coal based, diesel based & Gas based Turbine. Schematic diagram of each of these types and their site selection and limitations. Constituents in steam power station.</p> <p>Hydro Electric:</p> <p>Schematic arrangement of Hydro-Electric Power Station. Choice of site for Hydro Electric Power Station. Constituents of Hydro Electric Plant. types of Hydro Electric Power station. Make up of plant like Dam, conduit, penstocks and scroll case, draft tube and tailrace etc.</p>

	<p>Nuclear:</p> <p>Schematic arrangement of Nuclear Power Station. Composition of an atomic Nucleus. Types of nuclear reactor, Pressure water reactor, Light water reactor, heavy water reactor, Boiling water reactor, High temperature gas reactor, fast breeder reactor principle, Nuclear fusion. Selection of site for Nuclear Power Station. Comparison of above Power Plant.</p> <p>Non-Conventional An introduction to Power generation through non-conventional power generation such as Solar, Bio-Gas, Wind energy and Micro-hydel.</p>
<p>Identification and specification of different type of insulating materials used.</p> <p>Installation of insulators on HT & LT line.</p> <p>Binding of Pin type insulator, shackle type and suspension type insulators.</p> <p>Skinning and dressing of cables.</p> <p>Straight joint of different types of underground cables.</p> <p>Test /check the insulation resistance of cables by using megger.</p> <p>Locating the faults (open circuit, short circuit & leakage) in cables.</p> <p>Fixing of jumper by crimping tool.</p>	<p>TRANSMISSION OF ELECTRICAL POWER</p> <p>Electrical Supply System :</p> <p>Typical constant current power supply scheme, Comparison of AC and DC transmission. Advantages of High transmission voltage. Various system of power transmission and their comparison.</p> <p>Introduction to High voltage DC transmission system (HV DC).</p> <p>Introduction to Single phase , three phase-3 wire system in transmission lines</p> <p>Electrical supply system used in railway transportation.</p> <p>Overhead Lines: Main components of overhead lines-Types of powerline Low voltage line medium Voltage line & high voltage line Voltage standard Conductor materials, line supports, Insulators, types of Insulators, Potential distribution over suspension insulator string, string efficiency & method of its improvement.</p> <p>Corona : Introduction to Corona and its effects, factors affecting corona loss & methods of reducing loss, sag of conductor between two poles.</p>

	<p>Performance of Transmission Lines: Classification of overhead transmission lines. i e Resistive line inductive line, inductive line with compensation & inductive line connecting two large systems</p> <p>Performance of single phase short transmission line. Three phase transmission line. Effect of load Power factor on regulation and efficiency.</p> <p>Under Ground Cable : Construction of cables. Material for cables, its insulation. Classification of cables, cables for 3-phase service, Laying of under ground cable. Types of cable faults and their location.</p>
<p>Installation operation and maintenance of oil circuit breaker.</p> <p>Installation, operation and repair of air circuit breaker.</p> <p>Installation, operation and repair of SF6 circuit breaker.</p> <p>Installation and operation of lightning arrestor on HT line.</p> <p>Installation of bus bar and bus coupler on LT line.</p> <p>Replacement and testing of transformer oil.</p> <p>Test and replacement of transformer bushes on HT &LT side.</p> <p>Test /Check protection relay on transformer.</p>	<p>DISTRIBUTION OF POWER</p> <p>Sub-station: Its function and equipment used in substation.</p> <p>Distribution System : Classification of distribution system-AC distribution, D.C. distribution, methods of obtaining 3-wire dc system. Overhead v/s underground distribution system.</p> <p>Introduction to Switch Gear: Essential features of switchgears. Switch gear equipments, bus-bar arrangement, Switch gear accommodation, Short circuit, faults in power system.</p> <p>Introduction to protection schemes – Types & Characteristics of relays (Overcurrent, Over voltage, IDMT, Differential protection scheme of transformer, Buchholz relay, Carrier protection schemes)</p> <p>Circuit Breakers : Circuit breakers - arc , Principles of arc extinction, Methods of arc extinction, Classification of circuit breakers, Oil circuit breakers Air-blast circuit breaker, Vaccum circuit breaker, SF6 circuit breaker, MCB, ELCB.</p>

	<p>Fuses Desirable characteristics of fuse element, Fuse element material, Types of fuses, HRC fuses, ICTP switch, Low voltage fuses, High voltage fuses, Current carrying capacity of fuse element, Difference between a fuse and a circuit breaker. Introduction of MOV lightning arrestors used in HT lines.</p> <p>Transformers Introduction, types, Power transformers, Distribution transformers, transformer on load, its losses, efficiency & regulation of transformer, condition for maximum efficiency, transformer oil & its dielectric strength, Resin base transformers.</p>
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Terminal Objective

After completion the participants will be able to :

- ✓ work on various sources of power generation .
- ✓ erect the transmission of different voltages.
- ✓ find faults in transmissions lines
- ✓ install circuit breaker / switch gear.
- ✓ find faults in distribution systems
- ✓ test and replace the safety measures of transforms
- ✓ to install different types of distribution system.
- ✓ test relays in various protection schemes
- ✓ test and maintain power & distribution transformer

II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees

Sl. No.	Name of Items	Quantity
1.	Measuring Tape Steel 100cm	17 Nos.
2.	Rule Steel 300mm	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.	Rubber Gloves	17 Nos.
18.	Voltage sensor (pencil type)/ Electronic Tester	17 Nos.
19.	Screw Driver Kit (Set of six blades with common insulated handle with neon tester)	17 Nos.
20.	Plier insulated 150 mm	17 Nos.
21.	Digital Multimeter	17 Nos.
22.	Soldering iron 25W, 230 V	17 Nos.

Sl. No.	Name of Item	Quantity
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 0- 6 mm capacity.	1 No.
18.	Drill machine electric Portable 0-12 mm capacity.	1 No.
19.	Oil cane 1/2 litre.	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.	Spanner single ended 6mm - 25 mm.	2 set.
28.	Spanner double ended 6 mm -19 mm.	2 set.
29.	Drills S.S. twist block 2 mm- 12 mm.	2 set.
30.	File flat 200 mm 2 nd cut.	4 Nos.
31.	File flat 200 mm bustard.	4 Nos.
32.	File round 200 mm bustard.	4 Nos.
33.	File round 150 mm 2 nd cut.	4 Nos.
34.	File flat 200 mm smooth.	4 Nos.
35.	Instrument files (set of 12).	2 set.
36.	Bench vice 100 mm jaw.	2 Nos.
37.	Bench vice 150 mm jaw.	4 Nos.
38.	Tap set 3 mm- 10 mm (set of 9).	2 set.
39.	Die set 3mm – 10 mm (set of 9).	2 set.
40.	Vice hand 50 mm jaw.	4 Nos.
41.	Multi meter (digital).	2 Nos.
42.	Ammeter MI, 0-25 A.	2 Nos.
43.	Ammeter MI, 0-5-10-15 A.	2 Nos.
44.	Tong tester 0-25 –50 A. (multi range).	2 Nos.
45.	Voltmeter 0- 600 V.	2 Nos.
46.	C T, (100/5A).	2 Nos.
47.	P T, (11000/ 400 V).	2 Nos.
48.	Megger 500 V, 1000 V manual / motorised	2 Nos. each

49.	Megger 1500 V clamp type		2 Nos.
50.	Megger 2500 V		2 Nos.
51.	Earth fault locator.		2 Nos.
52.	Earth tester.		2 Nos.
53.	Energy meter single phase 40 A 230 V.		2 Nos.
54.	Energy meter 3 phase 4 wire, 20 A 400 V.		2 Nos.
56.	Watt meter single phase 230 V, 3 KW.		2 Nos.
57.	Wattmeter 3 phase 400 V, 2 elements 3/5 KW.		2 Nos.
58.	Oil circuit breaker 5 KVA.		1 No.
59.	Air circuit breaker 5 KVA	SF6	1 No.
60.	circuit breaker		1 No.
61.	VCB 5 KVA.		1 No.
62.	MCB 5 KVA.		1 No.
63.	Oil testing kit.		1 No.
64.	Crimping tool variable		4 Nos.
65.	Transformer 5 KVA, oil cooled, fitted with safety/protection devices.		2 Nos.
66.	Transformer 10 KVA, oil cooled, fitted with safety/protection devices.		1 No.
67.	Coil winding machine with Adjustable Frame.		1 No.
68.	Ladder (Full Height)		As required
69.	Safety Rope (suitable size)		As required

Sl. No.	Workshop Furniture	Qty.
1	Instructor table & chair	1 each
2	Suitable work tables with Vices	As required
3	Table teak wood for Electrical Lab (with drawers) fitted with panel board with AC/DC power supply, ammeter, voltmeter, frequency meter, pf meter, dimmerstat etc. Insulation mats to cover below the table.	As required
4	Revolving Stool cum chair	16 nos
5	Green Glass Board	1 no.
6	Metal Rack	As required
7	Locker with 8 drawers (standard size)	2 nos.
8	Storage Almirah	As required
9	Book shelf (Glass panel)	1 no.
10	Fire fighting equipment, first aid box etc.	As required

UPGRADATION OF ITIs into CENTERS of
EXCELLENCE (CoE)

SECTOR / AREA: ELECTRICAL

BROAD BASED BASIC TRAINING
(One Year)

**MODULE – ECBT - 6: BASIC COMPUTER
OPERATING SKILL & ITS APPLICATION**

(Duration - 8 weeks)

BROAD BASED BASIC TRAINING

(One Year)

MODULE – ECBT - 6: BASIC COMPUTER OPERATING SKILL & ITS APPLICATION

(Duration - 8 weeks)

I) COURSE CONTENT

Practical	Theory
Practical demonstration of functions of various components of a computer .Use of keyboard Different keyboard Commands. Practice of note pad and mouse	To study different blocks/parts of Computer system Practical demonstration of various components/ functions of a computer Use of keyboard. Different Keyboard Commands Practice of note pad and use of mouse
Practice on various commands of DOS and Window to check, open Change properties etc. on a computer	Practice on various commands of DOS and Window to check, open, change properties etc. on a computer
Typing practice on notepad and painting Practice to open, save, close a document In MS word writing a letter editing and formatting methods-Inserting and work with table. Practice of working on spreadsheet, using function of mathematical operations like addition, subtraction of columns of worksheet and other formule. Creating graphs. Practice of creating different types of slides, master slides using different presentations.	Typing practice on notepad and painting practice to open, save, close a document in MS word, writing a letter, editing and formatting methods- Inserting and working with table.
Practice on opening a web page, creating mail addresses and down loading. Practice on net surfing.	Various aspect of Internet & Net surfing.
Simple programs on AutoCAD, Microcap 6/7	Introduction to electrical softwares – AutoCAD, Microcap 6/7 etc. (latest version)

Terminal Objective

After completion of the course, the trainee will be able to

- ✓ have operational skill of computer.
- ✓ to enter data, prepare bills, prepare tool list etc.
- ✓ down load information from internet
- ✓ draw electrical layouts, drawing, wiring diagrams
- ✓ Simulate simple electrical circuits

II) TOOLS, MACHINERY, EQUIPMENTS etc. for a batch of 16 trainees

Sl. No.	ITEMS	Qty. Required
1.	Computer System	
a.	Pentium IV Computer or latest (Server- Linux), 2.8 GHz & above, 1 GB RAM, 80 GB HDD, DVD Combo Drive, 15" Monitor, optical scroll mouse, multimedia key board, 32 bit LAN card with UPP port, necessary Drivers,	1 no.
b.	Pentium IV Computer or latest (Client- windows XP or higher) 2.8 GHz, 512 MBRAM, 40/80 GB HDD, DVD Combo Drive, 15"/17" Monitor, optical scroll mouse, multimedia key board, LAN card, necessary Drivers & Antivirus software	8 nos.
c.	Networking: Above Computer Systems connected in LAN	---
d.	Broad Band Internet Connection, minimum speed 256 Kbps	---
e.	Software latest MS Office Window (under the OS platform for clients)	8 nos.
f.	Software Auto CAD, Microcap 7 or equivalent (Licensed Version)	For each client
2.	UPS 500 VA Or Centralised UPS with 5 KVA Capacity	9 nos. or 1 no.
3.	Desk Top Laser printer (B&W)	2 no.
4.	Ink jet printer	1 no.
5.	Dot Matrix Printer	1 no.
6.	Scanner	1 no.
7.	LCD Projector with screen	1 no.
8.	Overhead Projector with screen	1 no.
9.	Charts of different engines	1 each
10.	Allen Key set of 12 pieces (2mm -14 mm)	1 set
11.	Philips screw driver Typeset of 5 pieces (100 mm to 300mm)	04 sets
12.	1.44 MB Floppy	As required
13.	CD (Rewritable)	As required

Sl.No.	Workshop Furniture	Qty.
1	Instructor table & chair	1 each
2	Computer Table	9 nos.
3	Revolving Stool cum chair	16 nos.
4	Green Glass Board/ White Board	1 no.
5	Metal Rack	As required
6	Locker with 8 drawers (standard size)	2 nos.
7	Storage Almirah	As required
8	Book shelf (Glass panel)	1 no.
9	Tables for Printers/Scanner/Projector	As required
10	Fire fighting equipment, first aid box etc.	As required

UPGRADATION OF ITIs into CENTERS of EXCELLENCE (CoE)

SECTOR / AREA: ELECTRICAL

BROAD BASED BASIC TRAINING

(One Year)

MODULE – ECBT - 7: WORKSHOP CALCULATION & SCIENCE

(Duration – 2 hours/week - 48 weeks)

**BROAD BASED BASIC TRAINING
(One Year)**

MODULE - VII: WORKSHOP CALCULATION & SCIENCE

(Duration -2 hours/week - 48 weeks)

I) COURSE CONTENT

1. Basic algebra - algebraic formula – quadratic equations
2. Trigonometry – Trigonometric functions – calculation of areas
3. Mensuration – Find the area and volume of different objects
4. Simple problems on lines, angles, triangles and circles, calculation of area etc.
5. Find the equivalent resistance on Series circuit, parallel circuit
6. Find the equivalent resistance, voltage and current across each component of a series circuit, parallel circuit and series parallel circuit.
7. Solve the series parallel and network circuits using Kirchoff's law
8. Problems related to the DC generator – induced emf, voltage drop, efficiency etc.
9. Dc motor torque – speed related problems
10. Series and parallel circuits of capacitors, charge and voltage
11. Inductors in series and in parallel
12. Find the ac quantities and draw the vector representation
13. Problems on series ac circuits, Impedance, power and power factor
14. Series and parallel resonance circuit, Q factor
15. Calculations on phase voltage, phase current, line voltage, line current in star and delta systems. Find the power and power factor.
16. Find the turns ratio, efficiency and losses in transformers.
17. Find the average dc, load current and efficiency in half wave and full wave rectifiers.
18. Find the I_B , I_C , I_E in various types of biasing circuits and Transistor configuration circuits.
19. Find the gain of the amplifier in various coupling circuits
20. Problems related to OP-AMP circuits
21. Calculate the voltage gain, Current gain and power gain in dB units

22. Problems related to Zener regulator, Series regulator and series parallel regulator circuits.
23. Find the frequency of oscillation in various oscillator circuits.
24. Stress and strain, modules of elasticity
25. Force, bending, twisting and shearing forces and applied problems.
26. Equilibriums of forces and composition of forces
27. Pressure, atmospheric pressure and absolute pressure, problems related with pressure.
28. Brief description of manufacturing process of Steel, Copper and Aluminum
29. Problem on Work, Power and Energy.
30. Meaning of Horse Power and Brake Horse Power
31. Problems on conversion of Decimal numbers to Binary.
32. Addition and subtraction of Binary Numbers
33. Heat and specific heat of solids, liquids and gases, heat gained and heat loss.

UPGRADATION OF ITIs into CENTERS of EXCELLENCE (CoE)

**SECTOR / AREA: ELECTRICAL
(2 YEARS)**

**BROAD BASED BASIC TRAINING
(One Year)**

MODULE – ECBT - 8: ENGINEERING DRAWING

(Duration – 2 hours/week - 48 weeks)

**BROAD BASED BASIC TRAINING
(One Year)**

MODULE – ECBT - 8: ENGINEERING DRAWING

(Duration -2 hours/week - 48 weeks)

I) COURSE CONTENT

1. Engineering drawing and its importance
2. Types of lines and their applications.
3. Free hand sketching of tools
4. Free hand sketching of nuts, bolts, screws, washers etc.
5. Lettering practice.
6. Dimensioning, their methods and specific uses.
7. Types of projections
8. Simple orthographic projections in 1st angle method.
9. 3rd angle projections of various objects and exercises with dimension
10. Isometric views of objects.
11. Sectioning and sectioned views.
12. Draw the symbols for various electrical circuits, measuring instruments, switches, fuses, protective and controlling devices in electrical circuits.
13. Wiring diagram for small houses.
14. Layout of AC/DC Panel board.
15. Simple Geometrical shape, hollow shapes
16. Battery charging circuits with detail of panel board and blue print reading
17. Diagram of connection of different types of AC/DC motors and their protective devices
18. Sketching different shapes of coils and reading of Blue print.
19. Diagram of lap, wave winding in different applications
20. Sketching of transformer & auxiliary parts & sectional views
21. Layout drawing of a sub station, power station
22. Draw the symbols of various electronic components.
23. Draw the circuit diagram of various types of rectifiers, amplifiers, oscillators, power supplies, Multivibrators and Inverters.
24. SCR motor speed control circuits.