

Course Curricula  
on

# Industrial Electrical Sector

Under Skill Development Initiative (SDI) Scheme  
Based on  
Modular Employable Skills (MES)

Government of India  
Ministry of Labour & Employment  
(DGE&T)

List of members attended the Trade Committee Meeting for designing the course curriculums under Skill Development Initiative Scheme (SDIS) based on Modular Employable Skills (MES) in **INDUSTRIAL ELECTRICAL SECTOR** held on 22.10.2009

<b>SL NO</b>	<b>Members with Designation S/Sri</b>	<b>Organization</b>	<b>Remarks</b>
1	S.D.Lahiri, Director	CSTARI,Kolkata	Chairman
2	Gouri Sankar Sarangi, Additional Chief Engineer	WBSEDCL, Kolkata	Member
3	Palas Gain, Electrical Engineer	J.J.Electric Aid,Kolkata	Member
4	Apurba Mondal, Electrical Engineer	Directorate of Electricity, Govt of West-Bengal	Member
5	Pralay Ray Chaudhury, Electrical Engineer	Ganges Jute Mills, Kolkata	Member
6	Harisankar Dutta, Chief Electrical Engineer	Ganges Jute Mills, Kolkata	Member
7	Sandip Chakraborty, Executive (Marketing)	Siemens Ltd, Kolkata	Member
8	Tara Shankar Lahiri, Electrical Engineer	Hastings Jute Mills, Kolkata	Member
9	Kamal Kumar Mandal, Senior. Electrical Engineer	Hukumchand Jute Mills	Member
10	Abhay Kumar Nevatia, Member, IJMA, Kolkata	Hastings Jute Mills, Kolkata	Member
11	Ranjan Gangopadhyay, Senior Training officer	Supervisors' Training Centre, Kanchrapara, Eastern Railway	Member
12	RRO.T.V.Mathew, Principal	Donbosco, Howrah	Member
13	Sibesh Kundu, Senior Instructor	Donbosco, Howrah	Member
14	Subrata Kr Das Assistant. Director	Directorate of Industrial Training, Govt of West-Bengal	Member
15	Shivaji Samaddar Senior Engineer	Ambuja Reality, Kolkata	Member
16	MD. Shakful Hassan, Foreman	ITI, Kalyani	Member
17	Anil Kumar, Joint Director	CSTARI,Kolkata	Member
18	M. C.Sharma, Joint Director	CSTARI,Kolkata	Member
19	L.K.Mulherjee, Deputy Director	CSTARI,Kolkata	Member
20	A. Nandi, Deputy Director	CSTARI,Kolkata	Member
21	P.K.Dutta, Assistant Director	CSTARI., Kolkata	Member
23	S.B.Sardar, Assistant Director	CSTARI., Kolkata	Member
24	R.N.Manna, Training Officer.	CSTARI., Kolkata	Member

**Course Curricula under Skill Development Initiative Scheme (SDIS)  
Based on Modular Employable Skills (MES)  
On Industrial Electrical sector**

**CONTENTS**

1. List of members attended the Trade Committee Meeting.....	2
2. Background.....	4
3. Frame Work for Skill Development based on Modular Employable Skills.....	4
4. Introduction.....	5
5. Age of Participants.....	6
6. Curriculum Development Process .....	6
7. Development of Core Competencies .....	6
8. Duration of the Programmes.....	7
9. Pathways to acquire Qualification.....	7
10. Methodology.....	7
11. Instructional Media Packages.....	7
12. Assessment.....	7
13. Certificate .....	7
14. Course Matrix .....	8
15. Module -1 Basic Electricity & House Wiring .....	9
16. Module-2 Motors, Transformer and Earthing: .....	11
17. Module-3: Cables and Industrial Equipments (Inverter, Lead Acid Battery and Operation of DG set) .....	14

## **Skill Development based on Modular Employable Skills (MES)**

### **Background**

The need for giving emphasis on Skill Development, especially for the educated unemployed youth (both for rural & urban) has been highlighted in various forums. Unfortunately, our country's current education system does not give any emphasis on development of skills. As a result, most of the educated/uneducated unemployed youths are found wanting in this area, which is becoming their Achilles heel.

As India is on the path of economic development and the share of service sector's contribution to the GDP of the country is increasing (54% of GDP) it is becoming imperative that Government of India along with other nodal agencies play an important role in providing employable skills, with special emphasis on Skills.

Hence, need of the hour is some policy change at Apex level which will address the needs of the changing economy and look at providing mandatory skills training to all educated unemployed youths, with a view to have them gainfully employed. This shift in policy will ultimately benefit all the stake holders, namely the individuals, industry, Government and the economy by way of providing employment, increasing the output/productivity and ultimately resulting in a higher GDP for the nation.

### **Frame work for skill development based on 'Modular Employable Skills (MES)'**

Very few opportunities for skill development are available for the above referred groups (educated unemployed youth). Most of the existing skill development programmes are long term in nature. Poor and less educated persons cannot afford long term training programmes due to higher entry qualifications, opportunity cost, etc. Therefore, a new framework for skill development has been evolved by the DGET to address the employability issues.

The **key features of new framework for skill development** are:

- Demand driven short term training courses based on modular employable skills decided in consultation with Industries.
- Flexible delivery mechanism (part time, week ends, full time)
- Different levels of programmes (foundation level as well as skill up gradation) to meet demands of various target groups
- Central Government will facilitate and promote training while vocational training providers (VTP) under the Govt. and Private Sector will provide training.
- Optimum utilization of existing infrastructure to make training cost effective.

- Testing of skills of trainees by independent assessing bodies who would not be involved in conduct of the training programme, to ensure that it is done impartially.
- Testing & certification of prior learning (skills of persons acquired informally)

The Short Term courses would be based on “Modular Employable Skills (MES)”.  
The **concept for the MES** is:

- ✓ Identification of minimum skills set. Which is sufficient to get an employment in the Labour market.
- ✓ It allows skills up gradation, multi skilling, multi entry and exit, vertical mobility and life long learning opportunities in a flexible manner.
- ✓ It also allows recognition of prior learning (certification of skills acquired informally) effectively.
- ✓ The modules in a sector when grouped together could lead to a qualification equivalent to National Trade Certificate or higher.
- ✓ Courses could be available from level 1 to level 3 in different vocations depending upon the need of the employer organisations.
- ✓ MES would benefit different target groups like:
  - Workers seeking certification of their skills acquired informally
  - Workers seeking skill up gradation
  - Early school drop-outs and unemployed
  - Previously child Labour and their family

## **INTRODUCTION**

Economic growth in India is increasingly supported by robust industrial growth. **Industrial Electrical** Sector is one of the relatively lesser known but significant sectors that support almost all industrial activities. However, notwithstanding its importance and size (INR 4 trillion), it has traditionally not been accorded the attention it deserves as a separate sector in itself. The level of inefficiency in **Industrial Electrical** activities in the country has been very high across all modes.

The required pace of efficiency and quality improvement will demand rapid development of capabilities of service providers. And with these **Industrial Electrical** activities being a service oriented sector, skill development will emerge as a key capability.

This lack of focus on developing manpower and skills for the sector has resulted in a significant gap in the numbers and quality of manpower in the **Industrial Electrical** sector.

This gap, unless addressed urgently, is likely to be a key impediment in the growth of the sector in India and in consequence, could impact growth in industry and manufacturing sectors as well.

This underscores the need identifying areas where such manpower and skill gaps are critical, and developing focused action plans to improve the situation.

A look at the required initiatives for manpower development in the **Industrial Electrical** sector makes it clear that sustainable development of the sector's manpower requires a collaborative public private effort. The level of commitment demonstrated by each stakeholder would largely determine the direction that the sector heads towards.

### **Age of participants**

The minimum age limit for persons to take part in the scheme is 15 years for module/1 of Industrial Electrical sector but there is no upper age limit.

### **Curriculum Development Process**

Following procedure is used for developing course curricula

- Identification of Employable Skills set in a sector based on division of work in the Labour market.
- Development of training modules corresponding to skills set identified so as to provide training for specific & fit for purpose
- Development of detailed curriculum and vetting by a trade committee and by the NCVT

(Close involvement of Employers Organizations, State Governments and experts, vocational Training providers and other stakeholders are ensured at each stage).

### **Development of Core Competencies**

Possession of proper attitudes is one of the most important attributes of a competent person. Without proper attitudes, the performance of a person gets adversely affected. Hence, systematic efforts will be made to develop attitudes during the training programme.

The trainees deal with men, materials and machines. They handle sophisticated tools and instruments. Positive attitudes have to be developed in the trainees by properly guiding them and setting up examples of good attitudes by demonstrated behaviors and by the environment provided during training.

Some important core competencies to be developed are:

1. Communication skills
2. Better usage of Vernacular/Local Language
3. Presentation skills
4. Self management
5. Resume preparation
6. GD participation/facing techniques
7. Interview facing techniques

Following competencies should also be developed:

1. Ability for planning, organizing and coordinating
2. Creative thinking, problem solving and decision-making
3. Leadership
4. Ability to bear stress
5. Negotiation

### **Duration of the Programmes**

Time taken to gain the qualification will vary according to the pathway taken and will be kept very flexible for persons with different backgrounds and experience. Duration has been prescribed in hours in the curriculum of individual module, which are based on the content and requirements of a MES Module. However, some persons may take more time than the prescribed time. They should be provided reasonable time to complete the course.

#### **Pathways to acquire Qualification:**

**Access to the qualification** could be through:

- ⊗ An approved training Programme.

### **Methodology**

The training methods to be used should be appropriate to the development of competencies. The focus of the programme is on “performing” and not on “Knowing”. Lecturing will be restricted to the minimum necessary and emphasis to be given for learning through active participation and involvement.

The training methods will be individual centered to make each person a competent one. Opportunities for individual work will be provided. The learning process will be continuously monitored and feedback will be provided on individual basis. Demonstrations using different models, audio visual aids and equipment will be used intensively.

### **Instructional Media Packages**

In order to maintain quality of training uniformly all over the country, instructional media packages (Imps) will be developed by the National Instructional Media Institute (NIMI), Chennai.

### **Assessment**

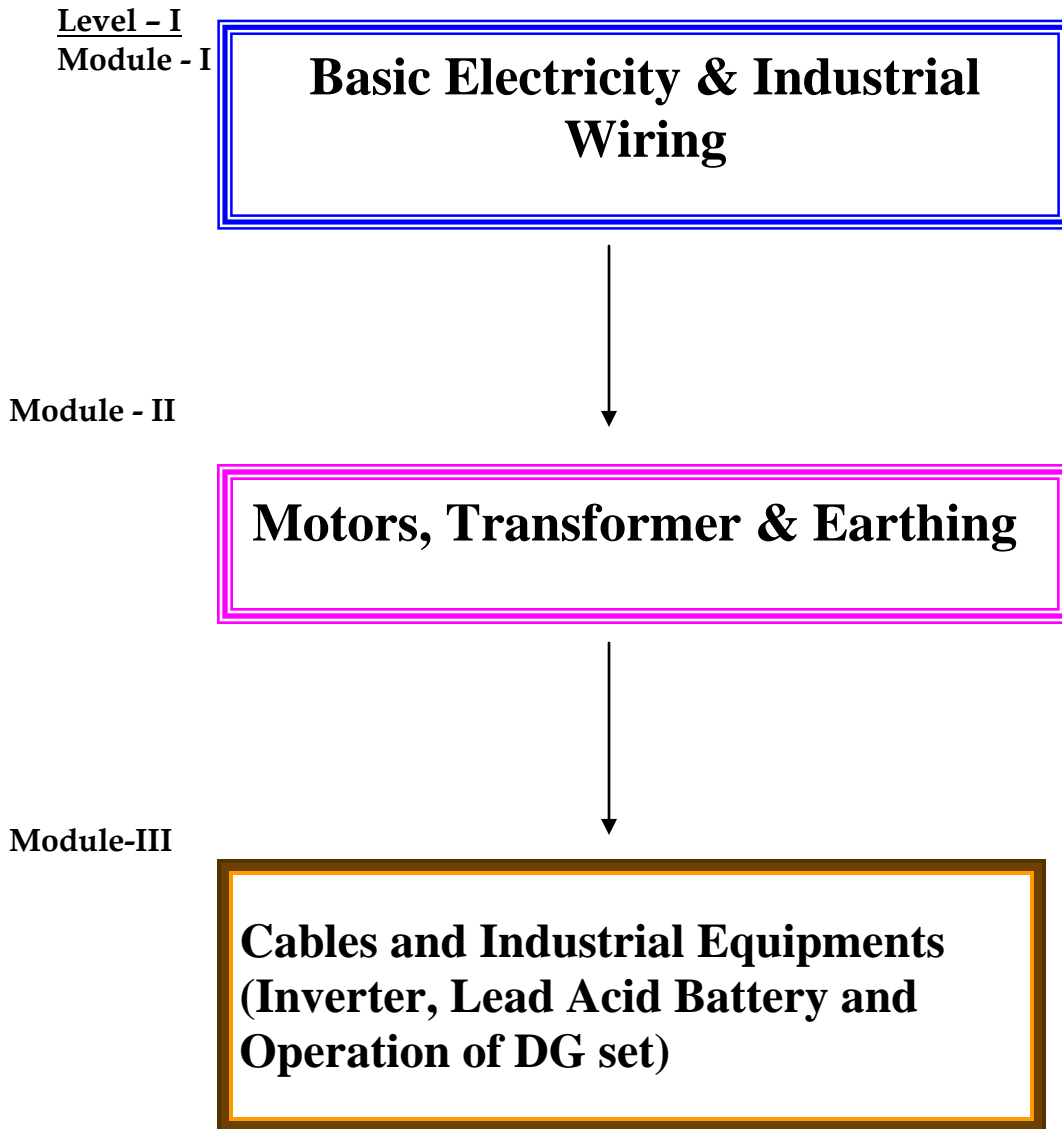
DGE&T will appoint assessing bodies to assess the competencies of the trained persons. The assessing body will be an independent agency, which will not be involved in conducting the training programme. This, in turn, will ensure quality of training and credibility of the scheme. Keeping in view, the target of providing training/testing of one million persons through out the country and to avoid monopoly, more than one assessing bodies will be appointed for a sector or an area.

### **Certificate**

Successful persons will be awarded competency-based certificates issued by **National Council for Vocational Training (NCVT)**.

Course Matrix

**INDUSTRIAL ELECTRICAL SECTOR**



## Module-1

**Name:** Basic Electricity & Industrial Wiring  
**Sector:** Industrial Electrical

**Code No:** IEL101  
**Entry Qualification:** 8<sup>th</sup> passed  
**Duration:** 240 hrs.

### Terminal Competency:

After completion of training the trainee will be able to:-

1. Perform Industrial wiring and its maintenance.
2. fault finding and trouble shooting

### Contents:

Sl. No.	Practical	Theory
1.	Demonstration on personal protection. Necessity of safety & remedies. Demonstration of shock prevention/remedies. Demonstration of fire extinguisher in electrical fire.	Knowledge of safety precautions for self & equipments. Causes and prevention of shock and first aid treatment of electrocuted person. Use of fire extinguisher.
2.	Identification, usage and maintenance of hand tools & measuring instruments.	Knowledge of hand Tools & Tools required for marking, punching, cutting, drilling, filing, stripping, clipping and fixing screws. Knowledge of Measuring Tools-tape, ruler, wire gauges etc. Classification / identification of the electrical equipments cables, wires and electrical accessories used in industrial wiring
3.	Practice on basic symbols used in electrical work, exercise involving different operation on wood, PVC sheets, pipes and plywood. Practice on wiring diagram.	Different types of wires & conductors, Load carrying capacity. Knowledge of Wiring diagram. Knowledge of different electrical wiring- residential, industrial and O.H. Lines. Types of conductors and insulators and their applications.
4.	Drilling holes on walls, PVC sheets by Portable drill machines. Making boards for switches.	Basic electrical concepts. AC, DC, single phase, 3 phase supply, voltage current, power and energy and its relationship. Ohm's law. Knowledge of Measurement of current, voltage, power using voltmeter, ammeter, wattmeter, energy meter, megger. Etc
5.	Practice and working on cable lay out and different circuits. Marking the position of different accessories and its connection.	Knowledge of series and parallel circuit, Uses of fuses, MCB & its selection.

	Connection practice of double pole switch.	
6	General work habits as per IE rules.	Knowledge of IE rules & regulation.
7	Practice in connection of different electrical fittings.	Knowledge of Properties of magnetizing metal.
8	Wiring practices of different types of wiring, execute wiring plan & estimation. Practice of Earthing & earth testing.	Types and importance of Earthing.
9	Checking & testing of Electrical wiring as per drawing. Fault finding and preventive maintenance, trouble shooting.	Types of faults and method of fault findings. Knowledge of Quality assurance required in Electrical works. Energy saving concept.
10	<b>Project Work, Revision &amp; Test</b>	

### Lists of Tools & Equipments for a batch of 16 trainees

Sl. No.	Tools & Equipments	Quantity
1.	Electrical tool kit	16 nos
2.	Hammers	16 nos.
3.	Portable drill machine and drill bits.	4 nos
4.	Multimeter	4 nos
5.	Megger	4 nos
6.	Line tester	4 nos
7.	Hack saw	16 nos
8.	Combination pliers	8 nos
9.	Nose pliers	8 nos
10.	Wire stripper	4 nos
11.	Wire gauge	4 nos
12.	Measuring tape	8 nos
13.	Screw drivers	16 nos
14.	Electrician knife	16 nos
15.	Try square	8 nos
16.	Centre punches	16 nos
17.	Switches, 2 way switches, sockets, regulators	As required
18.	ceiling roses, holders, plug tops	As required
19.	Fans, bulbs, fluorescent tubes	As required
20.	Chokes and starters	As required
21.	MCB, ICDP	As required
22.	Kit kat fuses, PVC board (Diff. sizes)	As required
23.	Hand gloves	16 pairs
24.	Cables, G.I. wires, pvc pipes and sheets, pvc casing capping	As required
25.	Junction boxes	As required
26.	Main switches	As required
27.	Earth tester	4 nos
28.	Energy meter, Volt meter, Ammeter	2 nos each
29.	Hammers(Small)	16 nos

**Level- I  
Module-II**

**Name:** Motors, Transformer and Earthing  
**Sector:** Industrial Electrical  
**Code No:** IEL102  
**Entry Qualification:** 8<sup>th</sup> passed  
**Duration:** 240 hrs.

**Terminal Competency:**

After completion of training the trainee will be able to:-

1. Run the single and 3 phase motor with different types of starter and its maintenance.
2. To connect step down and step up transformer and its testing including earthing.

**Contents:**

Sl. No.	Practical	Theory
1	Demonstration on personal protection. Necessity of safety & remedies. Demonstration of shock prevention & remedies. Demonstration of fire extinguisher in electrical fire.	Knowledge of safety precautions for self & equipments. Causes and prevention of shock and first aid treatment of electrocuted person. Use of fire extinguisher.
2	Demonstration on ammeter, voltmeter, wattmeter, energy meter, megger, power factor meter and frequency meter etc.	Basic electrical concepts. AC, DC, single phase, 3 phase supply, voltage current, power and energy and its relationship. Ohm's law. Knowledge of Measurement of current, voltage, power using ammeter, voltmeter, wattmeter, energy meter, megger, power factor meter and frequency meter etc. Concept of energy conservation.
3	Identification, usage and maintenance of hand tools & Measuring instruments.	Knowledge of tools required for-marking, punching, cutting, drilling, filing, stripping, crimping, socketing and fixing glands & screws etc. Knowledge of Measuring tools, wire gauges etc. Classification / identification of the electrical equipments cables, wires and electrical accessories used in industry.
4	Practice on motor star, delta connection. Connect star delta and DOL starter and a single phase motor. Starting method of slip ring induction motor	Knowledge of motors & types & their Construction. Working principle of Single phase motor & 3 phase induction motor. Difference between squirrel cage and slip ring induction motors.
5	Practice on control circuits of motors: - using on off switch locally and remote control. Demonstration on controlling of Speed and their measurements.	Knowledge of circuit diagram of motors & transformer. Working principle of DOL, Star Delta starter. Procedure of speed control.

	Forwarding & reversing control of motors. Auto star delta starter. Application of single phase preventor	Advantages of using DOL and star delta starter. Methods of speed control. Introduction to drive.
6	Tracing primary and secondary winding of transformer practice on parallel operation of transformer & Polarity test. Connection of Step-down transformer, 3 phase transformer in a given load. Testing dielectric strength of transformer oil, and its insulation.	Basic principle of transformer, types of transformers, protective device of transformer, identification of its different parts. Theory of BDV test.
7	General work habits as per IE rules.	Knowledge of IE rules & regulation.
8	Practice on pipe earthing and plate earthing.	Necessity of earthing, measurement and test of earthing.
9	Checking & testing of motors, transformer & ear thing.	Knowledge of Quality assurance required to repair motors & transformer.
10	Preventive maintenance and trouble shooting of faults.	
11	<b>Project Work, Revision &amp; Test</b>	

**Lists of Tools & Equipments for a batch of 16 trainees**

<b>Sl. No.</b>	<b>Tools &amp; Equipments</b>	<b>Quantity</b>
1.	Hammers	16 nos.
2.	Portable drill machine	4 nos
3.	Multimeter	4 nos
4.	Megger	4 nos
5.	Line tester	4 nos
6.	Hack saw	16 nos
7.	Combination pliers	8 nos
8.	Nose pliers	8 nos
9.	Wire stripper	4 nos
10.	Wire gauge	4 nos
11.	Measuring tape	8 nos
12.	Screw drivers	16 nos
13.	Electrician knife	16 nos
14.	Try square	8 nos
15.	Centre punches	16 nos
16.	Switches, sockets, regulators	As required
17.	ceiling roses, holders, plug tops	As required
18.	Fans, bulbs, fluorescent tubes	As required
19.	Chokes and starters	As required
20.	Hand gloves	16 nos
21.	Cables, G.I. wires, pvc pipes and copper plates	As required
22.	Junction boxes	As required
23.	Main switches	As required
24.	CT & PT	As required
25.	Energy meter	4 nos
26.	Hammers(Small)	16 nos
27.	Multimeter	4 nos
28.	Megger	4 nos
29.	Tong tester	4 nos
30.	Star Delta Starter	6 nos
31.	Earth tester	4 nos
32.	DOL Starter, slip ring motor starter.	4 nos
33.	Motors(Squirrel cage, slip ring induction motor)	2 nos
34.	Single phase & 3 phase Transformer	1 no each
35.	Single phase motor	1 no
36.	3 phase power starter with auxiliary contact	2 nos
37.	MCB, Kit kat fuses	As required
38.	Electronic tool kit	16 nos
39.	Tacho meter	1 no
40.	Power factor meter	1 no

**Level- I  
Module-III**

**Name:** **Cables and Industrial Equipments (Inverter, Lead Acid Battery and Operation of DG set)**

**Sector:** Industrial Electrical

**Code No:** IEL103

**Entry Qualification:** 8<sup>th</sup> passed

**Duration:** 240 hrs

**Terminal Competency:**

After completion of training the trainee will be able to:-

1. Identify the cable sizes and perform cable jointing
2. Check the condition of lead acid battery
3. Operation of DG Sets
4. Checking & Installation of Inverter.

**Contents:**

Sl. No.	Practical	Theory
1	Demonstration on personal protection. Necessity of safety & remedies. Demonstration of shock prevention/remedies. Demonstration of fire extinguisher in electrical fire.	Knowledge of safety precautions for self & equipments. Causes and prevention of shock and first aid treatment of electrocuted person. Use of fire extinguisher.
2	Demonstration on ammeter, voltmeter, wattmeter, energy meter, megger, power factor meter and frequency meter etc.	Basic electrical concepts. AC, DC, single phase, 3 phase supply, voltage current, power and energy and its relationship. Ohm's law. Knowledge of Measurement of current, voltage, power using ammeter, voltmeter, wattmeter, energy meter, megger, power factor meter and frequency meter etc. Concept of energy conservation.
3	Practice on Glanding of cables, lying of cables and different type of cable jointing.	Knowledge of Different types of cables, its uses and identification. As per IE rules choice of cable. Selection of cables as per given parameters.
4	Practice on cable trays bending 45° and 90°	Knowledge of Different types of trays .
5	Practice on identification of different parts of lead acid battery. Checking of its electrolyte. Charging practice of lead acid battery and its preventive maintenance. Testing of lead acid battery	Knowledge of Parts of lead acid battery. Knowledge of maintenance of lead acid battery.
6	Practice on starting method of DG Sets. Change of lubricant, coolant. Working on DG Set panel and its protection.	Knowledge of Function of DG sets different parts.
7	General work habits as per IE rules.	Knowledge of IE rules & regulation.
8	Practice on basic electronics circuit. Practice on different parts of inverter. Checking its faults. Testing of its rectifier, converter circuit.	Basic electronics and applications. Knowledge of inverter, rectifier and converter
9	Preventive maintenance of lead acid battery, inverter.	Knowledge of Quality assurance required to repair converter Inverter, Lead Acid Battery.
10	<b>Project Work, Revision &amp; Test</b>	

**Lists of Tools & Equipments for a batch of 16 trainees**

<b>Sl. No.</b>	<b>Tools &amp; Equipments</b>	<b>Quantity</b>
1.	Electrical tool kit (contents electrician hands tools)	16 nos
2.	Hammers	16 nos.
3.	Portable drill machine	4 nos
4.	Multimeter	4 nos
5.	Megger	4 nos
6.	Line tester	4 nos
7.	Hack saw	16 nos
8.	Combination pliers	8 nos
9.	Nose pliers	8 nos
10.	Wire stripper	4 nos
11.	Hand gloves	16 Nos.
12.	Earth tester	8 nos
13.	Screw drivers	16 nos
14.	Electrician knife	16 nos
15.	Try square	8 nos
16.	Centre punches	16 nos
17.	Cable trays(Ladder& Punched)	2 nos
18.	Inverter	1 no
19.	Lead acid battery	1 no
20.	Chargers	1 no
21.	Basic electronics components.	As reqd
22.	Kit Kat fuses	As required
23.	D G Sets	1 no
24.	Junction boxes	As required
25.	Main switches	As required
26.	Cables(Different type)	As required
27.	Thyrister	4 nos
28.	Hammers(Small)	16 nos
29.	Triac	4 nos
30.	Soldering flux	4 nos
31.	Blow lamp	4 nos
32.	Lug	16 nos
33.	Crimping machines	2 nos