CURRICULUM

FOR THE TRADE OF

POWER ELECTRICIAN

UNDER

APPRENTICESHIP TRAINING SCHEME

सत्यमेव जयते
Government of India

GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENURESHIP
DIRECTORATE GENERAL OF TRAINING

CONTENTS

1. ACKNOWLEDGEMENT

The DGT sincerely express appreciation for the contribution of the Industry, State Directorate, Trade Experts and all others who contributed in revising the curriculum. Special acknowledgement to the following industries/organizations who have contributed valuable inputs in revising the curricula through their expert members:

1. Koradi Thermal Power Station, Koradi (Nagpur)
2. Naval Dockyard Apprentice Mumbai
3. Torrent Power, Ahmedabad

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

Co-ordinator for the course: BN Sridhar, Dy Director, FTI, Bangalore

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Expert Group Designation
1.	Sanjay Kumar, Joint Director	CSTARI, Kolkata	Expert Member
2.	L.K. Mukherjee Dy Director	CSTARI, Kolkata	Expert Member
3.	Ketan Patel, Dy Director	RDAT, Mumbai	Expert member
4.	C.M.Diggewadi, Training Officer	RDAT, Mumbai	Expert member
5.	Umesh Kumar Mishra, Training officer	A.T.I.-Sion-Mumbai	Expert member

2. BACKGROUND

2.1 Apprenticeship Training Scheme under Apprentice Act 1961

The Apprentices Act, 1961 was enacted with the objective of regulating the programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate(ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry**.** There are four categories of apprentices namely**; trade apprentice, graduate, technician and technician (vocational) apprentices.**

Qualifications and period of apprenticeship training of **trade apprentices** vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department of Education, Ministry of Human Resource Development.

2.2 Changes in Industrial Scenario

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

2.3 Reformation

The Apprentices Act, 1961 has been amended and brought into effect from 22nd December, 2014 to make it more responsive to industry and youth. Key amendments are as given below:

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.

- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.

- Scope has been extended also to non-engineering occupations.

- Establishments have been permitted to outsource basic training in an institute of their choice.

- The burden of compliance on industry has been reduced significantly.

3. RATIONALE

(Need for Apprenticeship in POWER ELECTRICIAN trade)

It is generally observed that institutionally trained youth have not produced desired result because training imparted in institutions alone is not enough for acquisition of skills but needs to be supplemented by training in the actual world of work.

The Electrical Power sector plays a very important role not only in GDP growth but also in providing employment in the country. The utility electricity sector had an installed capacity of 304.761 GW as of 31 July 2016 in the country. The HV transmission lines (132 KV and above) installed in the country is nearly 7,00,000 Km. The length of transmission lines (400 V and above & excluding 220 V lines) is 10,558,177 Km as on 31 March 2015 in the country. The generation & transmission capacity is going to increase as per the Government vision to provide 24 Hours power supply to all over India so it is estimated that it requires more skilled workers every year. A large number of skilled workers coming out of technical institutes do not possess the required skills and are not readily employable. The industries have to spend time and money on their training. It has been observed that most of the existing Industrial Training Institutes run by the government and private sector do not have on the job training facilities.

It is therefore needed to interact with the industry to provide on the job training to the Semi skilled workers and also make changes in the curriculum. So to supply the skilled manpower demand, the Apprenticeship Training approach with the revised, industrial friendly curriculum is required.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

- Read and interpret the blue print reading (Electrical layout Drawing as per BIS specification & standards)
- Carryout Installation, maintenance & repair works of Electrical AC/ DC machinery, lighting circuits and equipments used in industries.
- Practice on using fitting carpentry and sheet metal tools.
- Use of electrical instrument(analog/digital) like voltmeter, Ammeter, Wattmeter, Energy Meter, Wheatstone bridge, oscilloscope, Earth tester, Tong tester, Megger etc to measure to different electrical quantities.
- Carry out Wiring & Earthing System.
- Carried out break down, over hauling, routine & preventive maintenance of electrical machines and equipments.
- Operate, maintain and test the switch gears, circuit breakers, relays and transformer
- Identify and maintain the Transmission and distribution system protecting devices.
- Carry out maintenance, test & fault finding in sub stations, transmission lines & distribution systems.
- Work on various sources of power generation & Control room.
- Erection, Testing & Maintenance of LT overhead lines, high tension (HT) & extra high tension (EHT) overhead line.
- Underground cable joining, testing & trouble shooting.

Reference NCO & NOS:

i) NCO-2004: 7137.10 (851.10)
ii) NCO-2004: 7241.10 (851.20)
ii) NCO-2004: 7241.20 (851.30)
iii) NCO-2004: 8161.45
iv) NCO-2004: 8161.50(961.50)

5. GENERAL INFORMATION

1. **Name of the Trade** **:** POWER ELECTRICIAN

2. **N.C.O. Code No. (**NCO-2004) :7137.10, 7241.10, 7241.20, 8161.45, 8161.50

3. **Duration of Apprenticeship Training (Basic Training + Practical Training):**2years

3.1 **For Freshers**: **Duration of Basic Training**: -

a) Block –I : 3 months

b) Block – II : 3 months

Total duration of Basic Training: 6 months

Duration of Practical Training (On -job Training): -

a) Block–I: 9 months

b) Block–II : 9 months

Total duration of Practical Training: 18 months

3.2 For ITI Passed: Duration of Basic Training: - NIL

Duration of Practical Training (On-job Training): 12 Months

4. **Entry Qualification** : Passed in 10th class examination under 10+2 system of education with science as one of the subject or its equivalent.

5. **Selection of Apprentices:** The apprentices will be selected as per Apprenticeship Act amended time to time.

6. Rebate for ITI passed trainees:- **One year rebate** for those who have passed **CTS- ELECTRICIAN** Trade.
They will undergo One year On-the-job Training

Note: Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.

6. COURSE STRUCTURE

Training duration details: -

Time (in months)	1-3	4-12	13-15	16-24
Basic Training	Block– I	-----	Block – II	------
Practical Training (On - job training)	----	Block – I	------	Block – II

Components of Training	Duration of Training in Months →																							
↓	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Basic Training Block - I																								
Practical Training Block - I																								
Basic Training Block - II																								
Practical Training Block - II																								

7. SYLLABUS

7.1 BASIC TRAINING
(BLOCK – I & II)
DURATION: 06 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** : **Power Electrician**
2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)
3) **Batch size** : 20 nos.
4) **Power Norms** : 5.2 KW for Workshop
5) **Space Norms** : 98 Sq.m. (For basic Training of Block-I & II)
6) **Examination** : The internal assessment will be held on completion of each Block.
7) **Instructor Qualification** :

i) Degree/Diploma in Electrical Engg. from recognized university/Board with one/two year post qualification experience respectively in the relevant field.

OR

ii) NTC/NAC in the trade of Electrician / Power Electrician with three year post qualification experience in the relevant field.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

8) **Tools, Equipments & Machinery required** : - As per Annexure – I

7.1.1 DETAIL SYLLABUS OF CORE SKILL

A. Block– I
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1	**Engineering Drawing: Introduction and its importance** - Viewing of engineering drawing sheets. Method of Folding of printed Drawing Sheet as per BIS SP:46-2003 **Drawing Instruments**: their Standard and uses - Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.	**30**	**Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units.	**20**
2	**Lines:** - Definition, types and applications in Drawing as per BIS SP:46-2003 - Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight, curved) - Drawing of parallel lines, perpendicular line - Methods of Division of line segment		**Fractions & Simplification**: Fractions, Decimal fraction, Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems Simplification using BODMAS.	
3	**Drawing of Geometrical Figures**: Definition, nomenclature and practice of - - Angle: Measurement and its types, method of bisecting.		**Square Root** : Square and Square Root, method of finding out square roots, Simple problem using calculator	

	- Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.			
4	**Lettering and Numbering** as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.		**Ratio & Proportion:** Simple calculation on related problems.	
5	**Free Hand sketch:** Hand tools and measuring instruments used **in Electrician / Power electrician trade.**		**Percentage:** Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	
6	**Free hand drawing :** - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension . - Transferring measurement from the given object to the free hand sketches.		**Material Science** : properties -Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.	

B. Block- II
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
		30		20
1	**Symbolic Representation** (as per BIS SP:46-2003) of : - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings		**Mass ,Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals	
2	**Construction of Scales and diagonal scale**		**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	
3	**Three phase Induction motor** Free hand sketching of Slip-ring and Squirrel cage Induction motor. Typical wiring diagram for drum controller operation of A.C. wound rotor motor.			
4	Drawing the schematic diagram of Autotransformer starter, DOL starter and Star Delta Starter. Drawing the schematic diagram of A.C. motor speed control by SCR /AC Drive.		**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	
5	**Distribution of Power** Types of insulator used in over head line. (Half sectional views) Different type of distribution systems and methods of connections. Layout diagram of a substation. Single line diagram of substation feeders.		**Mensuration :** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle. Volume of solids – cube, cuboid, cylinder and Sphere. Surface area of solids – cube, cuboid, cylinder and Sphere.	
			Trigonometry: Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding height and distance by trigonometry.	

7.1.2 DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

A. Block –I
Basic Training

Week No.	Professional Skills	Professional Knowledge
1	Implementation of various safety measures in the shop floor. Visit to different sections of the Institute. Demonstration of elementary first aid. Artificial Respiration. Practice on use of fire extinguishers. **Occupational Safety & Health.** **Importance of housekeeping & good shop floor practices.** Health, Safety and Environment guidelines, legislations & regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction, Personal protective Equipment(PPE):- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Use of Fire extinguishers.	**Occupational Safety & Health** Basic safety introduction, Personal protection:- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Use of Fire extinguishers. Visit & observation of sections. Various safety measures involved in the Industry. Elementary first Aid. Concept of Standard **Soft Skills**: its importance and Job area after completion of training. Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies eg; power failure, fire, and system failure.
2	Familiarization with signs and symbols of Electrical accessories.	Fundamental of electricity: Fundamental terms- Current, Voltage definitions, AC, DC, Phase, Neutral, Earth. Units & effects of electric current.
3	Skinning the cables Demonstration & Practice on bare conductors joints--such as rat tail, Britannia, straight, Tee, Western union Joints Practice in soldering & brazing Practice on crimping thimbles,	Solders, flux and soldering technique. Resistors types of resistors & properties of resistors. Introduction of National Electrical Code. Explanation, Definition and properties of conductors, insulators and semi-conductors. Types of wires & cables, standard wire gauge. Specification of wires & Cables-insulation & voltage

	Lugs. Demonstration and identification of types of cables. Demonstration & practice on using standard wire gauge & micrometer.	grades- Low , medium & high voltage
4	Verification of Ohm's Law, Measuring unknown resistance Verification of laws of series and parallel circuits. Experiment on poly phase circuits. Current, voltage, power and power factor measurement in single & poly- phase circuits. Measurement of energy in single and poly-phase circuits. - Use of phase sequence meter. Practice on three phase four wire system for understanding phase and line voltage & current.	Ohm's Law - Simple electrical circuits and problems. Reading of simple Electrical Layout. **Resistors -**Law of Resistance. Series and parallel circuits & related calculation. **Alternating Current -**Comparison and Advantages D.C and A.C. Related terms Frequency, Instantaneous value, R.M.S. value Average value, Peak factor, form factor, sine wave, phase and phase difference. Inductive and Capacitive reactance, Impedance (Z), power factor (p.f). Active and Reactive power. Single Phase and three-phase system etc. Power consumption in series and parallel, P.F. etc. Concept three-phase Star and Delta connection. Line and phase voltage, current and power in a 3 phase circuits with balanced and unbalanced load. Three phase four wire system Use of power analyzer, measurement of THd, Harmonics due to digital switching.
5	Demonstration of trade hand tools. Use, care & maintenance of various hand tools. Practice on installation and overhauling common electrical accessories as per simple Electrical circuit / Layout. Make test board.	Identification of Trade-Hand tools-Specifications Common Electrical Accessories, their specifications in line with NEC 2011-Explanation of switches lamp holders, plugs and sockets. Developments of domestic circuits, Alarm & switches, with individual switches, Two way switch .Security surveillance, Fire alarm, MCB, ELCB, MCCB. Series –parallel testing board & use.
6	Identification of parts of battery. Practice on Battery Charging, Preparation of battery charging, Testing of cells, Installation of batteries, Charging of batteries by different methods. Routine care & maintenance of Batteries	**Chemical** effect of electric current-Principle of electrolysis. Faraday's Law of electrolysis Lead acid cell-description, methods of charging-Precautions to be taken & testing equipment, Different types of lead acid cells. Sealed Maintenance free Batteries, Solar battery. Load & back up time calculation

7	**Practice on Earthing**- different methods of earthing. Measurement of Earth resistance by earth tester. Testing of Earth Leakage by ELCB and relay.	**Earthing**- Principle of different methods of earthing & selection. i.e. Pipe, Plate, etc Importance of Earthing. Improving of earth resistance Earth Leakage circuit breaker (ELCB).
8	**Diodes**-symbol - Tests - Construct & Test Half wave rectifier ckt. Full wave rectifier ckt. Bridge rectifier ckt. Measurement & calculation of electrical parameters using C.R.O. Different wave shapes of rectifiers and their values using C.R.O. Identification of terminals, construction & Testing of transistor. Operation, maintenance & troubleshooting of inverter, Voltage stabilizer, DC regulated power supply, UPS, etc	**Basic electronics**- Semiconductor energy level, atomic structure 'P' type and 'N' type. Type of materials –P-N-junction. Classification of Diodes – Reverse and Forward Bias, Heat sink. Specification of Diode PIV rating. Explanation and importance of D.C. rectifier circuit. Half wave, Full wave and Bridge circuit. Filter circuits-passive filter. Working principle and uses of an oscilloscope. Types of transistors & its application. Specification and rating of transistors.
9	Practice in casing, Capping and Conduit wiring . Testing of wiring installation by meggar. -Fixing of calling bells/buzzers. Identification & demonstration on conduits and accessories & their uses, cutting , threading & laying Installation, Testing, Maintenance and Repairing of wiring. Application of fuses, relay, MCB, ELCB.	**Electric wirings**, I.E. rules. Types & selection of wirings both domestic and industrial. Specifications for wiring. Grading of cables and current ratings. Principle of laying out in domestic wiring. Estimate the cost of wiring system Voltage drop concept. **Wiring system -** P.V.C., concealed system. Specifications, standards for conduits and accessories - Power Wiring - Control Wiring - Information Communication - Entertainment Wiring. Testing of wiring installation by meggar Study of Fuses, Relays, Miniature circuit breakers (MCB), ELCB, etc.
10-11	Identification of the parts of a D.C. machine. No load & Load performance of a different type of DC generator. Calculation of regulation & efficiency.	**D.C. Machines -** General concept of Electrical Machines. **Principle of D.C. generator.** Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring Brushes, Laminated core.

	Connect, start, run and reverse a different type of DC motor. load performance test on different type of DC motor& calculation of efficiency. speed of a DC motor by different method. Maintenance, troubleshooting & servicing of DC machines. Overhaul a DC machine.	Explanation of **D.C. Generators**-types, parts-Practical uses. Description of series, shunt and compound generators and their selection. Types of D. C. Motor. Starters used in D.C. motors Types of speed control of DC motors in industry. Application of D.C. motors. Care, Routine & preventive maintenance.
12	Identification of types of transformers. Connection of transformers, Transformation ratio, testing of transformer, calculate the losses & efficiency. Use of Current Transformer (C.T.) and Potential (Voltage) transformer (P.T.) Testing of single phase and Three Phase Transformers - Cleaning, maintenance, testing and changing of oil.	Working principle of **Transformer,** losses & efficiency. classification C.T., P.T. Instrument and Auto Transformer(Variac), Construction, Single phase and Poly phase. Type of Cooling for transformer. Protective devices. Components, Auxiliary parts i.e. breather, Conservator, buchholz relay, other protective devices. Transformer oil testing and Tap changer (off load and on load). Dry type transformer. Bushings and termination.
13	Identify & select different type of Instruments. Use of **-P**MMC , MI meter, Multi-meter(Digital/Analog) , Wattmeter, P F meter, Energy meter, Frequency meter, Phase sequence meter, Digital Instruments, etc Range extension of meters.	**Electrical Measuring Instruments -** -types, indicating types PMMC & MI meter (Ammeter, Voltmeter) -Range extension -Multimeter(Digital/Analog) -Wattmeter - P.F. meter - Energy meter (Digital/analog) –Insulation Tester (Megger), Earth tester. -Frequency meter -Phase Sequence meter -Multimeter –Analog and Digital -Tong tester -Techometer.
	Assessment/Examination 03days	

B. Block –II
Basic Training

Week No.	Professional Skills	Professional Knowledge
1-2	Identification of parts and terminals of AC motors. Connection, starting, running of AC motors using Starters. Load test & efficiency calculation. Rotor resistance starter, etc Speed control of Induction motors by various methods. Practical application of A.C. motors. Connection of single phase motor, identification, testing, running and reversing. Maintain, service and trouble shoot the single phase motor. Install a single phase motor. Overhauling of AC motors.	**Three phase Induction motor** – Working principle –Production of rotating magnetic field, Squirrel Cage Induction motor, Slip-ring induction motor. Control & Power circuit of starters D.O.L Starter, Forward /Reverse starter, Star /Delta starter, Autotransformer starter, Rotor resistance starter, etc Single phasing preventer. Application of Induction Motor Care, Routine & preventive maintenance. **Single phase induction motor-** Working principle, different method of starting and running (capacitor start, permanent capacitor, capacitor start & run, shaded pole technique). FHP motors, Repulsion motor, stepper motor, Application of single phase motor.
3	Connect, start and run a 3 phase synchronous motor Practice for Power factor correction.	**SYNCHRONOUS MOTOR -** Working principle, effect of change of excitation and load. Power factor correction of industrial load
4-5	Identification of parts and terminals of Alternator. Connection, starting, running of Alternator. Practice on alternators, voltage Building,, Parallel operation & load sharing. Practice on installation, running and maintenance of Alternators.	**Alternator** Explanation of alternator, working principle, voltage build-up, loading, Regulation. Types of prime mover, phase sequence, Parallel operation & load sharing. Specification of alternators
6-7	Prepare layout plan, single line diagram of different type of power plant.	**POWER GENERATION :** Generation sources of energy, Comparison of energy resources. Types of fuels. Advantages of liquid fuel & solid fuel. Various ways of electrical power generation. • Thermal • Gas • Hydro electric • Nuclear • Non-Conventional , Schematic arrangement & Comparison of above Power Plant.

8-9	Prepare layout plan and single line diagram of transmission system with all accessories utilized. Schematic of a overhead and domestic service line. Binding of Pin type insulator, shackle type and suspension type insulators. Straight joint of different types of underground cables. Fixing of jumper by crimping tool. Test the underground cables for open, short circuit & ground fault and also check insulation resistance.	**Transmission Of Electrical Power** **Electrical Supply System:** Comparison of AC and DC transmission. Advantages of High transmission voltage. Various system of power transmission and their comparison. Introduction to High voltage DC transmission system (HV DC). Introduction to Single phase , three phase-3 wire system in transmission lines **Overhead Lines:** Main components of overhead lines-Types of powerline Low voltage line, medium Voltage line & high voltage line,, line supports, Insulators, types of Insulators, Potential distribution over suspension insulator string, string efficiency & method of its improvement. **Performance of Transmission Lines:** Performance of single phase short transmission line. Three phase transmission line. Effect of load Power factor on regulation and efficiency. **Under Ground Cable :** Construction of cables. Material for cables, its insulation. Classification of cables, cables for 3-phase service, Laying of underground cable. Types of cable faults and their location.
10-11	Prepare layout plan and single line diagram of Distribution system with all accessories. Erect an overhead service line pole for single phase 240v distribution system. Replacement of oil and testing of its die-electric. Recharge the silica gel in breather. Testing and charging of	**DISTRIBUTION OF POWER** **Sub-station:** Its function and equipment used in substation. **Distribution System :** Classification of distribution system-AC distribution, D.C. distribution, methods of obtaining 3-wire dc system. Overhead v/s underground distribution system. **Introduction to Switch Gear:** Essential features of switchgears. Switch gear equipments, bus-bar arrangement, Switch gear accommodation, Short circuit, faults in power system. **Introduction to protection schemes –**

	emergency battery.	Types & Characteristics of relays (Overcurrent, Over voltage, IDMT, Differential protection scheme of transformer, Buchholz relay, Carrier protection schemes)
12-13	Schematic diagram of a different type of Circuit Breakers. Replacement of fuse element. Installation of fuses on H.T. Line & L.T. Line . Test /Check different type of protection relay. Schematic diagram of a different type of Switch utilization on HT & LT lines.	**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. **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 lightening arrestors used in HT lines. **Relays:** Their types, viz. over current, earth fault relay, wire differential, Buchholz's relays, their operation and maintenance. Horn Gap Switches/ Air break switch, Disconnect Switch, Grounding Switch, Surge Arrestors & Current Limiting Reactors: Its working and utilization on HT& LT lines.
	Assessment/Examination 03days	

7.1.3 EMPLOYABILITY SKILLS

GENERAL INFORMATION

1)	**Name of the subject**	**:**	**EMPLOYABILITY SKILLS**
2)	**Applicability**	**:**	ATS- Mandatory for fresher only
3)	**Hours of Instruction**	**:**	**110 Hrs. (55 hrs. in each block)**
4)	**Examination**	**:**	The examination will be held at the end of two years Training by NCVT.
5)	**Instructor Qualification**	**:**	

i) MBA/BBA with two years experience or graduate in sociology/social welfare/Economics with two years experience and trained in Employability skill from DGET Institute.

And

Must have studied in English/Communication Skill and Basic Computer at 12th /diploma level

OR

ii) Existing Social Study Instructor duly trained in Employability Skill from DGET Institute.

7.1.3.1 SYLLABUS OF EMPLOYABILITY SKILLS

A. Block – I
Basic Training

Topic No.	Topic	Duration (in hours)
	English Literacy	**15**
1	**Pronunciation :** Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
2	**Functional Grammar** Transformation of sentences, Voice change, Change of tense, Spellings.	
3	**Reading** Reading and understanding simple sentences about self, work and environment	
4	**Writing** Construction of simple sentences Writing simple English	
5	**Speaking / Spoken English** Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.	
	I.T. Literacy	**15**
1	**Basics of Computer** Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
2	**Computer Operating System** Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.	
3	**Word processing and Worksheet** Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets	
4	**Computer Networking and INTERNET** Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites	

	and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.	
	Communication Skill	**25**
1	**Introduction to Communication Skills** Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body - language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort. Case study/Exercise	
2	**Listening Skills** Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.	
3	**Motivational Training** Characteristics Essential to Achieving Success The Power of Positive Attitude Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning. Case study/Exercise	
4	**Facing Interviews** Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview	
5	**Behavioral Skills** Organizational Behavior Problem Solving Confidence Building Attitude Decision making Case study/Exercise	

B. Block– II
Basic Training

Topic No.	Topic	Duration (in hours)
	Entrepreneurship skill	**15**
1	**Concept of Entrepreneurship** **Entrepreneurship**- Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. Management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.	
2	**Project Preparation & Marketing analysis** Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of Product Life Cycle (PLC), Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.	
3	**Institutions Support** Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.	
4	**Investment Procurement** Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.	
	Productivity	**10**
1	**Productivity** Definition, Necessity, Meaning of GDP.	
2	**Affecting Factors** Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.	
3	**Comparison with developed countries** Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.	
4	**Personal Finance Management** Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	Occupational Safety, Health & Environment Education	**15**
1	**Safety & Health** Introduction to Occupational Safety and Health importance of safety and health at workplace.	

2	**Occupational Hazards** Basic Hazards, Chemical Hazards, Vibro-acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.	
3	**Accident & safety** Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.	
4	**First Aid** Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
5	**Basic Provisions** Idea of basic provision legislation of India. of safety, health, welfare under legislation of India.	
6	**Ecosystem** Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.	
7	**Pollution** Pollution and pollutants including liquid, gaseous, solid and hazardous waste.	
8	**Energy Conservation** Conservation of Energy, re-use and recycle.	
9	**Global warming** Global warming, climate change and Ozone layer depletion.	
10	**Ground Water** Hydrological cycle, ground and surface water, Conservation and Harvesting of water	
11	**Environment** Right attitude towards environment, Maintenance of in -house environment	
	Labour Welfare Legislation	**5**
1	**Welfare Acts** Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.	
	Quality Tools	**10**
1	**Quality Consciousness :** Meaning of quality, Quality Characteristic	
2	**Quality Circles :** Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.	
3	**Quality Management System :** Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.	
4	**House Keeping :** Purpose of Housekeeping, Practice of good Housekeeping.	
5	**Quality Tools** Basic quality tools with a few examples	

7.2 PRACTICAL TRAINING (ON-JOB TRAINING)
(BLOCK – I & II)
DURATION: 18 MONTHS (9 months in each block)

GENERAL INFORMATION

1) **Name of the Trade** : **Power Electrician**

2) **Duration of On-Job Training** : As per Apprenticeship Act amended time to time.

3) **Batch size** : 20

4) **Examination** : i) The internal assessment will be held on completion of each block

ii) NCVT exam will be conducted at the end of 2nd year.

5) **Instructor Qualification** :

i) Degree/Diploma in Electrical Engg. from recognized university/Board With one/two year post qualification experience in the relevant field.

OR

ii) NTC/NAC in the trade of Electrician / Power Electrician with three year post qualification experience in the relevant field.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

6) **Tools, Equipments & Machinery required** : - As per Annexure – II

7.2.1 BROAD SKILL COMPONENT TO BE COVERED DURING ON-JOB TRAINING

A. BLOCK – I (09 months)

Week No.	Professional Skills
1	Observe & practice safety in all electrical works. Practice providing First Aid.
2	Identify & use all hand tools
3	Check the gauges of wire & select suitable wires for the required current rating. Practice wire joints & providing cable glands. Soldering practice.
4	Carryout fitting & carpentry jobs
5	Connect & measure voltage, current, resistance power & energy in DC & AC(1ph & 3ph) circuits Use of power analyzer, measurement of THd, Harmonics due to digital switching.
6	Electrical wiring: Repair / replace switches, sockets, light points. Provide new points in PVC casing capping & PVC conduits.
7	Charging & maintenance of different type of Batteries. Checking specific gravity, voltage, condition monitoring of Battery Bank, assessment of high spots, on line isolation precautions etc.
8	Install pipe & plate earth stations. Measure earth resistance, improve the same & maintain earth stations. Earth Monitoring systems with reference to various standards, familiarization with health monitoring equipment.
9	Providing power supply to motors, equipments& appliances. Crimping the lugs, providing cable glands & connections.
10	Attending to minor faults in machines, their controls & appliances.
11	Replacing the bulbs, tubes, trouble shooting, repair & maintenance. Wire up in PVC casing & capping.
12	Assisting in operation & maintenance of Transformer substation, circuit breakers, batteries etc
13	Trouble shooting rectifiers, filters, power supplies, voltage stabilizers, controlled rectifiers. Identifying faulty thyristors in circuits, replacing them
14	Provide light/socket points, for various equipments and appliances
15	Decides the size of cable & provides power supply to machines & equipments, provide earth connections.
16	Tesing the condition of DC motor Checking power input & output in DC drives. Replacing faulty components.
	Project Work
	REVISION
	Examination

B. BLOCK – II (09 months)

Week No.	Professional Skills
1	Observe & practice safety in all electrical works. Practice providing First Aid
2	Connection & testing of single & three phase motor. Checking power input & output in AC drives. Replacing faulty components Power factor correction using Synchronous motor.
3	Diesel Generating set: Operation, operating switch gears, trouble shooting & maintenance
4	Parallel operation of Generators to a infinite bus bar. Protective system for Generator. Care and maintenance of Alternator.
5	Preventive & corrective maintenance of various Power Station equipment. Different protections for power plant. Power station emergencies & handling.
6	Checking Electrical connections, locating faults and removal of faults in Air Compressor, AC plants, cranes, lifts, hoists. Operates & maintain Air compressor, AC plant, cranes, lifts, hoists
7	Trouble shoot & repair machine tools
8	Operation of Control Room. Operation of Switchgear. Use of PLCC/ SCADA. Reading of panel meter & filling log sheet. Preparing report.
9	Erection of high tension (HT) and extra high tension (EHT) overhead line. Testing of HT/EHT overhead lines. Maintenance of overhead lines equipment.
10	Underground cable joining, HT/LT . Testing of underground cables, trouble shooting, Locating faults, open circuit, short circuit & leakage in cables, performing cable joints Maintenance of lightening arrestor.
11	Installation operation and maintenance of oil circuit breaker, Air circuit breaker, SF6 circuit breaker, Vaccum circuit breaker, etc.
12	Maintenance of transformer equipment such as : Oil gauge, Tap Changer, Bushes, Breather, Earth fault relay, Protective relay, etc.
13	Erection of LT overhead lines. Testing & maintenance of LT overhead lines. Type and procedure of attending complaints. Different type of control switches erection. Commission of street light poles, cable circuits & lamps.
	Project Work
	REVISION

	Examination

8. ASSESSMENT STANDARD

8.1 Assessment Guideline:

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration to be given while assessing for team work, avoidance/reduction of scrape/wastage and disposal of scarp/wastage as per procedure, behavioral attitude and regularity in training.

The following marking pattern to be adopted while assessing:

a) Weightage in the range of 60-75% to be allotted during assessment under following performance level:

For this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- many tolerances while undertaking different work are in line with those demanded by the component/job.
- a fairly good level of neatness and consistency in the finish
- occasional support in completing the project/job.

b) Weightage in the range of above75%- 90% to be allotted during assessment under following performance level:

For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- the majority of tolerances while undertaking different work are in line with those demanded by the component/job.
- a good level of neatness and consistency in the finish
- little support in completing the project/job

c) Weightage in the range of above 90% to be allotted during assessment under following performance level:

For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.

In this work there is evidence of:

- high skill levels in the use of hand tools, machine tools and workshop equipment
- tolerances while undertaking different work being substantially in line with those demanded by the component/job.
- a high level of neatness and consistency in the finish.
- minimal or no support in completing the project

8.2 FINAL ASSESSMENT- ALL INDIA TRADE TEST (SUMMATIVE ASSESSMENT)

SUBJECTS	Marks	Sessional Marks	Full Marks	Pass Marks	Duration of Exam.
Practical	300	100	400	240	**08 hrs.**
Trade Theory	100	20	120	48	3 hrs.
Workshop Cal. & Sc.	50	10	60	24	3 hrs.
Engineering Drawing	50	20	70	28	4 hrs.
Employability Skill	50		50	17	2 hrs.
Grand Total	**550**	**150**	**700**	**-**	

Note: - The candidate pass in each subject conducted under all India trade test.

9. FURTHER LEARNING PATHWAYS

Employment opportunities:

On successful completion of this course, the candidates shall be gainfully employed in the following industries:

1. Power Generation, Transmission & Distribution industries.
2. Central & State Government and Public sector
3. Private industries in India & abroad.
4. Infrastructure and defence organisations
5. Self employment

ANNEXURE – I

TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: POWER ELECTRICIAN

LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity
1	Steel tape, 3 mt length	21 nos.
2	Plier insulated, 150mm	21 nos.
3	Plier side cutting 150mm	21 nos.
4	Nose plier, 150mm	21 nos.
5	Screw driver, 150 mm	21 nos.
6	Electrician connector screwdriver, insulated handle thin stem, 100mm	21 nos.
7	Heavy duty screwdriver, 200mm	21 nos.
8	Electrician Screwdriver, thin stem, insulated handle, 250mm	21 nos.
9	Punch centre, 150mmX9mm	21 nos.
10	Electrician knife, 50 mm blade	21 nos.
11	Neon tester	21 nos.
12	Steel rule, 300mm	21 nos.
13	Hammer, Cross peen with handle, 250 gm	21 nos.
14	Hammer, ball peen with handle, 750gm	21 nos.
15	Gimlet, 6mm	21 nos.
16	Bradawl, 150mm x 6mm	21 nos.
17	Pincer, 150 mm	21 nos.
18	Scriber (knurled centre position)	21 nos.
19	Digital multimeter	21 nos.

B : TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS

Sl. No.	Name of the items	Quantity (Indicative)
1	C- clamp, 100mm, 150mm, 200mm	2 Nos. each
2	Adjustable spanner, 150mm, 300mm	2 Nos. each
3	Blow lamp, 0.5 ltr	1
4	Melting pot	1
5	Ladel	1
6	Chisel cold firmer, 25mm x 200 mm	2
7	Chisel 25mm & 6 mm	2 Nos. each
8	Hand drill machine	2
9	Portable electric drill machine, 12 mm capacity	1
10	Pillar Electric Drill machine, 12 mm capacity	1
11	Allen key set	2 sets
12	Oil can 0.12 ltr	1
13	Grease gun	1
14	Out side Micrometer	2
15	Motorised Bench grinder	1
16	Rawl plug tool & bit	2 sets
17	Pulley puller	2
18	Bearing puller	2
19	Pipe vice	2
20	Thermo meter 0-100 deg C	1
21	Scissors blade 150mm	2
22	Crimping tool	2 sets
23	Wire stripper 20 Cm	2
24	Chissel cold flat 12mm	2
25	Mallet hard wood 0.5Kg	2
26	Mallet hard wood 1 Kg	2
27	Hammer extractor type, 0.4 Kg	2
28	Hacksaw frame, 200mm & 300mm adjustable	2 each
29	Try square, 150 mm blade	2
30	Outside & inside divider caliper	2 each
31	Pliers flat nose 150mm	4
32	Pliers round nose, 100 mm	4
33	Tweezers, 100mm	4
34	Snip straight & bent, 150mm	2 each
35	Double ended spanner set metric	2 sets

36	HSS drill bit set(2-12mm)	4 sets
37	Plane, smoothing cutters 50mm	2
38	Gauge, wire imperial	2
39	File, flat 200mm 2nd cut	8
40	File half round 200 mm 2nd cut	4
41	File round 200mm 2nd cut	4
42	File flat 150mm rough	4
43	File flat 250mm bastard	4
44	File flat 250mm smooth	4
45	File Rasp half round 200 mm bastard	4
46	Soldering iron, 25 W, 65 W	2 each
47	Copper bit soldering iron 0.25 kg	2
48	Desoldering gun	4
49	Hand vice 50mm jaw	4
50	Bench vice 100mm jaw	6
51	Pipe cutter to cut pipes upto 5cm dia	2
52	Stock & die set for 20mm to 50 mm GI pipe	1
53	Stock & dies conduit	1
54	Ohm meter; series & shunt type	2 each
55	Multimeter (analog), 0-1000 M ohm, 2.5 to 500V	2
56	Digital Multimeter	4
57	AC voltmeter MI 0-500V	2
58	Milli Voltmeter centre zero 100-0-100 mV	1
59	DC milli Ammeter 0-500 mA	1
60	Ammeter MC 0-5A, 0-25A	1 each
61	AC Ammeter MI 0-5A, 0-25A	1 each
62	KiloWatt meter 0-1-3 KW	1
63	AC Energy meter, single phase 5A, 3 ph 15 A	1 each
64	Power factor meter, single phase	1
65	Frequency meter	1
66	Flux meter	1
67	DC power supply 0-30V, 2 Amp	2
68	Rheostats 0-1 ohm 5A, 0-10 ohm 5A, 0-25 ohm 1A, 0-300 ohm 1A	1 each
69	Digital Tachometer	1
70	Growler	1
71	Tong tester / clamp meter 0-100 A AC	1
72	Meggar 500V	1
73	Oscilloscope dual trace, 30 MHz	1
74	Function Generator	1
75	Hygrometer	1
76	Lux meter	1
77	Hydro meter	1

78	Current transformer, 415 V, 50 Hz , CT Ratio 10/5A,	1
79	Potential Transformer, 415/110 V	1
80	Wood Saw, 250 mm	1
81	Tenon Saw	1
82	Guarded Test Lamp	1

C : GENERAL MACHINERY INSTALLATIONS:-

Sl. No.	Name of the items	Quantity
1	Voltage Stabilizer, input 15-230 V AC, Output 220 V AC	1
2	3 point DC starter	1
3	4 point DC starter	1
4	Electrical Machine Trainer: suitable for demonstrating the construction & functioning of different types of DC machines & AC machines (single phase & 3 phase). Should be fitted with brake arrangement, Dynamometer, Instrument panel & power supply unit	1
5	Motor generator (AC to DC): consisting of : Squirrel cage induction motor with star delta starter & directly coupled to DC shunt generator & switch board mounted with regulator, air breaker, ammeter, voltmeter, knife blade switches & fuses, set complete with case iron & plate, fixing bolts, foundation bolts & flexible coupling. Induction motor rating: 5 KW, 400V, 50 Hz, 3 ph. DC shunt generator rating: 3.5 KW, 220V	1 set
6	Used DC generators – series, shunt & compound type, (for overhauling practice)	1 each
7	DC shunt motor 2 – 2.5 KW, 220V	1
8	DC series motor coupled with mechanical load, 2 KW, 220V	1
9	DC compound motor with starter & switch, 2.5 KW, 220V,	1
10	Single phase Transformer, core type, air cooled, 1 KVA, 240/415 V, 50Hz	3
11	3 phase transformer, shell type, oil cooled with all mounting, 3 KVA, 415/240V, 50 Hz (Delta /Star)	2
12	Starters for 2 to 5 HP AC motors. a. Resistance type starter. b. Direct on line starter. c. Star delta starter – Manual, semi-automatic & Automatic. d. Auto Transformer type starter	1 each
13	Motor generator (DC to AC) set consisting of Shunt motor with starting compensator & switch directly coupled to AC generator with exciter & switch board mounted with regulator, breaker, ammeter, voltmeter, frequency meter, knife blade switch & fuses etc. Set complete with cast iron bed plate, fixing bolts, foundation bolts & flexible coupling. Shunt motor Rating- 5KW, 220V. AC generator rating – 3 ph, 4 wire, 3.5 KVA, 400/230 V, 0.8 pf, 50 Hz	1 set
14	AC squirrel cage induction motor with star delta starter & triple pole Iron	1

	clad switch fuse. 2 to 3 HP, 3 ph, 400V, 50 Hz	
15	AC 3 ph wound slipring motor with starter & switch, 5 HP, 400V, 50 Hz	1
17	Single phase capacitor motor with starter switch, 1 HP, 230 V, 50 Hz	1
18	Universal motor with starter / switch, 230 V, ¼ HP, 50 Hz	1
19	Stepper Motor with digital controller,	1
20	Shaded pole motor,	1
21	3 ph Synchronous motor, 3 HP, 415 V, 50 Hz, 4 pole, with accessories	1
22	Domestic Appliacnes: Electric hot plate, 1500W	1
23	Electric kettle, 1500W	1
24	Electric Iron, 1500 W	1
25	Immersion heater, 1500 W	1
26	Ceiling fan	1
27	Geyser storage type, 15 lts min	1
28	Mixer & Grinder	1
29	Washing Machine	1
30	Inverter, 1 KVA with 12 V battery, input 12 V DC, Output 220V AC	1
31	Thyristor /IGBT controlled DC motor Drive, with tachogenerator feed back arrangement, 1 HP	1 set
32	Thyristor / IGBT controlled AC motor Drive with VVVF control, 3 ph, 2 HP,	1 set
33	Battery charger	1
34	1 Ph variable Auto Transformer	1
35	Load bank, 5 KW. lamp / heater type	1
36	Brake test arrangement with 2 spring balance, 0 to 25 Kg rating	1
37	Discreet component trainer	2
38	Oil testing kit	1

Note: In case of basic training setup by the industry the tools, equipment and machinery available in the industry may also be used for imparting basic training.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: POWER ELECTRICIAN

LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

1) **Space Norms** : 45 Sq. m.(For Engineering Drawing)

2) Infrastructure:

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity (indicative)
1.	Draughtsman drawing instrument box	20
2.	Set square celluloid 45^0 (250 X 1.5 mm)	20
3.	Set square celluloid 30^0-60^0 (250 X 1.5 mm)	20
4.	Mini drafter	20
5.	Drawing board (700mm x500 mm) IS: 1444	20

B : FURNITURE REQUIRED

Sl. No.	Name of the items	Quantity (indicative)
1	Drawing Board	20
2	Models : Solid & cut section	as required
3	Drawing Table for trainees	as required
4	Stool for trainees	as required
5	Cupboard (big)	01
6	White Board (size: 8ft. x 4ft.)	01
7	Trainer's Table	01
8	Trainer's Chair	01

ANNEXURE – II

TOOLS & EQUIPMENT FOR ON-JOB TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

TRADE: POWER ELECTRICIAN

For Batch of 20 APPRENTICES

Actual training will depend on the existing facilities available in the establishments. However, the industry should ensure that the broad skills defined against On-Job Training part (i.e. 9 months + 9 months) are imparted. In case of any short fall the concern industry may impart the training in cluster mode/ any other industry/ at ITI.

ANNEXURE-III

GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

1. Due care to be taken for proper & inclusive delivery among the batch. Some of the following some method of delivery may be adopted:

A) LECTURE
B) LESSON
C) DEMONSTRATION
D) PRACTICE
E) GROUP DISCUSSION
F) DISCUSSION WITH PEER GROUP
G) PROJECT WORK
H) INDUSTRIAL VISIT

2. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. may be adopted.

3. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.