CURRICULUM

FOR THE TRADE OF

Lineman

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. BBMP, Nangal
2. BBMB Dhulkote
3. NHPC Chamera-1
4. Bangalore Electric Supply Company

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.	D.L.Meena, ADT	RDAT Faridabad	Member
2.	Shreeshail P., Training Officer	FTI Banglore	Member
3.	D.P.Rana, Training Officer	RDAT Faridabad	Member
4.	Suresh Kumar Dhiman, Training Officer	RDAT FBD	Member
5.	D. Panchal,, Instructor	ATI Jodhpur	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 Lineman 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.

Linemen, commonly referred to as outside linemen, are skilled electricians who construct, service and maintain the high-power lines and equipment that carry and transmit and distribute electrical power from the generating source to the end user. Linemen typically gain their skills through a formal apprenticeship program, which requires approximately three years to complete. Requirements for entry into a lineman apprenticeship program vary by employer, but usually include provisions for age, education and physical fitness. Lineman can also install and maintain telephone, telegraph, cable TV and more recent fiber optic lines.

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

4. JOB ROLES: REFERENCE

Brief description of Job roles:

The trainee shall be able to perform the erection, maintenance, and repairs on the electrical overhead transmission, distribution and underground distribution system. He must be able to operate, inspect, and maintain aerial devices, digger/derricks, insulators, excavation equipment, and other electric line related equipment. Makes connections and solders terminals. Test electrical installations and equipment and locates faults using Megger, test lamps etc.. Repairs or replaces defective insulator, wiring, burnt out fuses and defective parts and keeps fittings and fixtures in working order. Power linemen work on electrically energized (live) and de-energized (dead) power lines. Linemen may perform a number of tasks associated with power lines, including installation or replacement of distribution equipment such as capacitor banks, distribution transformers on poles, insulators and fuses. These duties include the use of ropes, knots, and lifting equipment. These tasks may have to be performed with primitive manual tools where accessibility is limited.

Erects various equipments such as bus bars, panel boards, electrical posts, insulators, fuse boxes switch gears, meters, relays etc, using non-conductors, insulation hoisting equipment as necessary for receipt and distribution of electric current to feeder lines. Installation of motors, generators, transformer and other related equipment etc, as per drawings using lifting and hoisting equipment as necessary, does prescribed electrical wiring, and connects to supply line.

Reference NCO & NOS:

N.C.O. Code No. :NCO 2004: 7245.10

OLD: (857.10)

5. GENERAL INFORMATION

1. **Name of the Trade** **: Lineman**

2. **N.C.O. Code No.** : 7245.10 (857.10)

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** : 8th Class under 10+2 System of Education

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

6. **Rebate for ITI passed trainees** : **One year rebate** for those who have passed **CTS- WIREMAN** 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** : **Lineman**
2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)
3) **Batch size** : 16
4) **Power Norms** : 5.0 KW for Workshop
5) **Space Norms** : 88 Sq.m.

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/Lineman 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**	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, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals	
3	**Drawing of Geometrical Figures**: Definition, nomenclature and practice of - - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus,		**Percentage** : Introduction, Simple calculation.	

	Parallelogram. - Circle and its elements			
4	**Lettering and Numbering** as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.		**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	
5	Free Hand sketch of hand tools, measuring tools used in Electrician /wireman/ Lineman trade. Free hand sketch of wire joints.			

Block – II
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1	**Signs & Symbols of AC/DC System** Symbols used in electrical circuits. Electrical components.	**30**	**Mass ,Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals	**20**
2	Electrical wiring diagram of different lamps, room (3/4 point), stair case. Schematic diagram of plate and pipe earthing,		Square Root: Square and square root, method of finding out square roots. Simple problem using calculation.	
3	Types of insulator used in over head line. (Half sectional views)		**Mensuration :** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Surface area of solids – cube, cuboid, cylinder and Sphere.	
4	Layout diagram of a substation . Single line Diagram of Electrical substation feeders.		Volume of solids – cube, cuboid, cylinder and Sphere. measurement of angles.	

7.1.2 DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

A. Block –I

Basic Training

Week No.	Professional Skills	Professional Knowledge
1.	Maintain Safety measures/precautions. Preventive measures for electrical accidents & steps to be taken in such accidents. Demonstration of Types of Fire extinguishers and use of Fire extinguishers. Demonstration of artificial respiration	**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. Artificial Respiration.
	Identification of Trade Hand Tools, proper use, care and maintenance	Demonstration of Trade Hand Tool. Identification of Clamps, Saw, Rivets, Bolts and maintenance of various hand tools.
2	Familiarization with signs and symbols of Electrical accessories.	Fundamental of electricity: Electron theory- free electron, Fundamental terms- Current, Voltage definitions, AC, DC, Phase, Neutral, Earth. Units & effects of electric current.
	Study of different types LT/HT symbols, single line diagrames of sub stations	Reading of LT/HT symbols, single line diagrams.
	Measurement of vltage,current and reistance, Verification of Ohm's law	Ohms Law and Law of resistance i.e. Series Parallel resistance, Specific resistance.
3	Practice of Drilling, Chiseling, Sawing, Filing, Chipping.	Use of Fitter & Carpenter Hand Tools
	Use of Black Smith Basic Hand Tool	Simple Forging & Hardening & Tempering of common smithy Tools
	Practice of different types of welding and Brazing	Simple Welding and Brazing
	Use of Sheet metal Workers Hand Tools	Simple Cutting, Bending, Jointing
4	Practice of Joints of Cables or conductor of Single Strands.	Making Joints using Single Strands Conductor
	Practice of different types of Joints of Cables or conductor of multi Strands.	Making Joints using multi Strands Conductor
5.	Practice of Soldering joints using Aluminum flux and Alca 'P' Solder	Soldering Joints
	Practice of Crimp Joints using Aluminum and Copper Conductor	Use of Crimping tool, wire stripper, different types of lugs.
	Practice to joint cable by removing insulation, armour, jointing of conductors. Cable glanding and	Cable Jointing, cable joining teqniqes, types of cable joning kits and its specifications.

	termination with TPST switches.	
6.	Practice on fixing and connection of plugs, sockets, Lamp holder, regulator , tube light fixture	Fixing & Connecting switches
	Practice to clamp different conductor, cable	Use of clamps
7.	Practice to connect Cut outs in line & uses of Fuses.	Use of Cut outs & Fuses
	Practice on Earthing- different methods of earthing. Measurement of Earth resistance by earth tester or earth Megger. Testing of Earth Leakage by ELCB and relay. Field Testing of line insulators	**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.	Identification of parts of battery. Practice on Battery Charging, Preparation of Electrolyte, checking specific gravity of Electrolyte, 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, series & parallel connection of cells/batteries. 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.
	Preparing of Electromagnet	Study of Electromagnetic Induction, self induction, mutual induction
9	Identification of different type of Instruments. Use of **-**PMMC , MI meter, Multi meter (Digital/Analog) , Wattmeter, P F meter, Energy meter, Frequency meter, Phase sequence meter, Digital Instruments, etc Range selection & Range extension of meters.	**Electrical Measuring Instruments -** -types, indicating types PMMC & MI meter (Ammeter, Voltmeter) -Range extension -MultiMater(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 -Tachometer.
	Practice in casing, Capping (PVC) and Conduit wiring . Testing of wiring installation by multi meter, megger. 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. Fuses, ELCB, MPCB	**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 megger Study of Fuses, Relays, Miniature circuit breakers (MCB), ELCB, etc.
10.	Practice on Wiring for internal Lighting & External Lighting, power wiring, AEH wiring.	**Layout of Lighting, and Power Circuit.**
	Government Specification for **Rural & Urban Area Electrification**	**Rural & Urban Area Electrification.**
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. Connect, start, run and reverse a different type of DC motor. Study of starters for DC motors. load performance test on different types of DC motors & calculation of efficiency. Speed control of a DC motor by different method. Maintenance, troubleshooting & servicing of DC machines. Overhaul a DC machine.	**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. 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	Demonstration and identification of types of cables. Demonstration and practice on using standard wire gauge & micrometer. Practice on crimping thimbles, Lugs.	Introduction of National Electrical Code Voltage grading of different types of Insulators, Temp. Rise permissible. Types of wires and cables standard wire gauge. Specification of wires and Cables-insulation and voltage grades -Low , medium and high voltage, Precautions in using various types of cables / Ferrules
13	Identification of types of Transformers. Connection of transformers, Transformation ratio, testing of transformer,. Use of Current Transformer (C.T.) and Potential (Voltage) transformer (P.T.) Testing of CT & PT Testing of single phase and Three Phase Transformers - Cleaning, maintenance, testing and changing and checking of oil.	Working principle of Transformer, Types, construction & classification. Single phase and Poly phase.Type of Cooling for transformer. losses & efficiency. Auto Transformer(Variac), Construction, working principle, Auxiliary parts i.e. breather, Conservator, buchholz relay, other protective devices. C.T., P.T . Transformer oil testing and Tap changer (off load and on load). Dry type transformer.Bushings and termination..
	Internal Assessment 03days	

B. Block –II
Basic Training

Week No.	Professional Skills	Professional Knowledge
1.	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.	Recognize & comply safe working practices, environment regulation and housekeeping.
	Identify different hand tools and their uses during working on line.	Demonstration of Lineman Hand Tools.
2.	Practice to climb & working on Ladders, its operation.	Uses of Ladders, Draw vice.
	Practice to erect pole	Erecting of poles.
3.	Identify different insulators and practice to fix on pole.	Types of Insulators i.e pin, disc,suspension Strain etc
	Fixing of cross arms on poles	Use of cross Arm
	Uses of pulley block & lifting tackles during erection or maintenance of poles/tower.	Pulley blocks and Lifting tackles
4.	Schematic of a overhead and domestic service line. Prepare layout plan and single line diagram of transmission /Distribution system. Trouble shooting and servicing of LT/HT circuit breaker. Connect feeder cable/ service line to the bus bar. Thermal classification of insulating materials.	**POWER GENERATION :** Various ways of electrical power generation. Thermal, Hydro electric, Nuclear, Non-Conventional **Overhead Lines**: Main components of overhead lines-Types of power line Low voltage line medium Voltage line & high voltage line Voltage standard (LV, HV, EHV) Conductor materials, line supports, Insulators, types of Insulators
	Fixing of Stay Rod and brackets on poles	Use of Stay Rod, brackets.
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	**Alternator** Explanation of alternator, working principle, voltage build-up, loading, Regulation. Types of prime mover, phase sequence, Parallel operation & load sharing. Specification of alternators

	maintenance of Alternators.	
	Earthling of HT lines/transformer with earth plate & practice.	Use of Earth plates for low & H.T. overhead lines and transformer.
6..	Identify & Practice to connect Lightening Arrestors at Grid Substation or HT lines.	Use of Lightening Arrestors
	Connection of Meter at consumer end and connection on pole of service line on pole.	Wiring & Installation of KWH Meter
7.	Laying of low tension UG cable for distribution purpose.	Laying of underground Cables
	Planning of overhead line, marking poles, type of insulator required, and stringing mechanism involved.	Layout and stringing overhead lines.
	Practice on Wire joint for different type of conductors.	Wire Jointing. Different types of cable joints.
8.	Erection of towers by Build-up method or Piecemeal method or Section method or Ground assembly method.	Tower Erecting
	Parameter used in erecting line .Locating and staking line	Conductor Arrangement, Ground clearance, Wire crossing clearance, sag table
9	Practice to climb on tower and painting of tower after erection to avoid corrosion and dismantling of damage or expire poles/towers.	Scraping and Painting of pole and Tower.
10.	Erection and maintenance of pole type transformer and tap changing.	Pole type Transformer and tap changing gear
	Testing of Dielectric strength of Transformer oil using oil Testing Kit	Transformer oil and its Testing
	Use of ACB, OCB,SF6 Circuit Breaker, Isolator in line and alarm	Types of Circuit Breaker, Isolator and alarms. Dual incoming supply, Bus coupler
11	Operation & maintenance of indoor & outdoor substation.	Knowledge of indoor & outdoor substation
	Detection of faults using apparatus and remove fault. Connection of junction box	Detection of faults,Junction Boxes in line
	Practice to work on hot line (HT lines) using apparatus of protection.	Hot line operation
12	Practice to fit different dampers on lines	Use of Dampers.
	Practice to connect or disconnect transformer, apply fuse to transformer and maintenance of transformer	Transformers connections, STAR and DELTA, protective devices.
13.	Towers-rigid and Flexible, Mounting cross Arms, pin/disc insulator etc.. Tower and line erection – Foundation & sequence of operations.	Transmission line and their types(AC/DC),HVDC What is Corona, & sag, tension in overhead Transmission line.
	Internal Assessment 03 days	

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** : **LINEMAN**

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

3) **Batch size** : 16

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/Lineman 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

1. Observe & practice safety in all electrical works. Practice providing First Aid
2. Identify & use all hand tools
3. Practice of Drilling, Chiseling, Sawing, Filing, Chipping.
4. Practice of different types of welding , Drilling, Chiseling, Sawing, Filing, Chipping.
5. Making different types of Joints of Cables or conductor of Single or multi Strands.
6. Practice of Jumper and Jumper connections
7. Fixing and connection of plugs, sockets, Lamp holder & regulator.
8. Electrical wiring: Repair / replace switches, sockets, light points. Provide new points in PVC casing capping & PVC conduits.
9. **Practice on Earthing**- different methods of earthing. Install pipe & plate earth stations Measure earth resistance, improve the same & maintain earth stations.
10. Practice to joint cable by removing insulation, armour, jointing of conductors.
11. Practice in casing, Capping (PVC) and Conduit wiring .
12. Connect & measure voltage, current, resistance power & energy in DC & AC(1ph & 3ph) circuits
13. Charging & maintenance of Batteries. Checking specific gravity, voltage etc.
14. Three Phase connection-Star Delta.
15. Soldering joints using Aluminum flux and Alca 'P' Solder.
16. Crimping of different types of cables & conductors.
17. Assisting in operation & maintenance of Transformer substation, circuit breakers, batteries etc
18. Distribution system-Feeders, Distribution centre, Primary mains, Secondary mains.
19. Connecting, programming, testing & Functioning of DC drive. Understanding the alarm & fault indications.
20. Wiring for internal Lighting & External Lighting.
21. Project work
22. Revision

B. BLOCK – II

1. Observe & practice safety in all electrical works. Practice providing First Aid.
2. Practice to climb & working on Ladders, its operation.
3. Practice to erect different type of pole.
4. Fixing of brackets, stay rod, insulator on pole, Fixing of cross arms on poles.
5. Operation of fuse of all type Circuit Breaker, Isolator & Connection of junction box.
6. Connecting power and control wiring of Diesel Generating set. Operation, operating switch gears, trouble shooting & basic maintenance.
7. **Earthling of HT lines with earth plate.**
8. Ground wire and Lightening Arrestors of different type at Grid Substation or HT lines.
9. Assisting in stringing of overhead line HT/LT**.**
10. Assisting during erection of towers by Build-up method –Foundation and sequence of operation.
11. Underground cable joining, HT/LT

10. Testing of underground cables or overhead cable, trouble shooting, Locating faults, open circuit, short circuit & leakage in cables.

12. Operates & maintains transformer substation & equipments like circuit breakers, batteries and other controlling devices.
13. Practice to climb on tower and painting of tower after erection to avoid corrosion and dismantling of damage or expire poles/towers.
14. Three phase Transmission and their maintenance, faults location using apparatus and remove fault.
15. Distribution –Three phase Three wire, Three phase four Wire, Single phase two Wire and three wire.
16. Jumper & Jumper Connections, D-link Gange operated switch ,HT blades
17. Erection and maintenance of pole type transformer and tap changing.
18. Charging or discharging of line using circuit breaker, Isolator.
19. Operation & maintenance of Solar cells and Non conventional energy generation system.
20. Tower and Tower line erection-Foundation and sequence of operations. Mounting cross arm, pins insulator and Damper etc.
21. Project work
22. Revision

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 Govt. & Private power distribution companies.

2. In public sector industries, State Electricity Boards, etc and private industries involved in distribution, Generation and transmission in India & abroad.

3. Self employment.

ANNEXURE – I

TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: Lineman

LIST OF TOOLS & EQUIPMENTS FOR Lineman APPRENTICES

A : TRAINEES TOOL KIT:-

I

Sl. No.	Name of the items	Quantity (indicative)
1.	10" Adjustable Wrench	16
2.	12" Adjustable Wrench	16
3.	Adjustable spanner, 150mm, 300mm	16 Each
4.	Box spanner set.	16
5.	Nut Bolt Bag	16
6.	Tools Bag (Electrician Tool kit)	16
7.	Chisel (Cold and firmer)	16
8.	Hack saw frame 200 mm & 300 mm adjustable	16
9.	Cutting Plier Heavy duty	16
10.	Screw Driver Insulated 250 mm	16
11.	Screw Driver Insulated 250 mm Heavy duty	16
12.	Power Tester (Neon tester)	16
13.	Ball Pen Hammer	16
14.	Pole Climber	16
15.	Cuff Work Gloves(High Tension)	16
16.	Safety Belt	16
17.	Safety helmet	16

18.	Cuff Work Gloves	16
19.	Channel Lock Plier	16
20.	protective blankets	16
21.	rubber gloves, protective blankets	16

B : TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS

Sl. No.	Name of the items	Quantity (indicative)
1.	Blow lamp, 0.5 ltr	01
2	Melting pot	01
3	Ladel	01
4	Chisel cold firmer, 25mm x 200 mm	02
5	Hand drill machine	2
6	Portable electric drill machine, 12 mm capacity	1
7	Pipe vice	2
8.	Hacksaw frame, 200mm & 300mm adjustable	2 each
9.	Chissel cold flat 12mm	2
10	File flat 150mm rough	02
11.	File flat 250mm bastard	02
12	Pliers flat nose 150mm	4
13	Pliers round nose, 100 mm	4
14	Tweezers, 100mm	4
15	Snip straight & bent, 150mm	2 each
16	Double ended spanner set metric	2 sets
17	Copper bit soldering iron 0.25 kg	2
18	Rubber gloves 1000V	2 pairs
19	Insulators (Different type)	02 each type
20.	Conductor (AAA, ACSR, AACSR)	10 Meter each

21.	Brackets	02
22.	Wooden Ladder	01
23	Drilling Machine	01
24	Cut out and Fuses	02
25	Wire Gauge	02
26	Earth Plate	02
27	Megger 1000 V, 1500 V	02
28	Current transformer 10/1, 20/1,30/1,50/5, 100/5 and 300/5A	1 each
29	Potential transformer 220/110, 300/110, 440/110, 600/110	1 each
30	Clamps	10
31	Pulley Block	01
32	Earth Tester	02
33	AC voltmeter MI 0-500V	2
34	AC Ammeter MI 0-5A, 0-25A	02
35	Power factor meter, single phase	1
36	Frequency meter	1
37	Hydro meter	1
38	Earth leakage circuit breaker (ELCB) 220V/25mA	02
39	Safety belt with provision for keeping tools	5
40	DC power supply 0-30V, 10 Amp	2
41	Multi Meter	10
42	Clamp on meter 300 Amp	2
43	Ohm meter; series & shunt type.	2
44	Type of Conductors	All type
45	Clamps	10
46	KWH Meter	01
47	Tri vector meter	02
48	Ropes & Rigging	As required
49	Fist Aid Box	02

C : GENERAL MACHINERY INSTALLATIONS:-

Sl. No.	Name & Description of Machines	Quantity (indicative)
1.	DC Motor 05 KVA	01
2	Types of Pole	As req.
3	Brackets	05
4	Pulley block	01
5	First Aid Facility	02
6	Crimping Tool(Light Duty)	02

7	Crimping Tool(Heavy Duty)	02
8.	Insulation Tester	02
9.	Draw Vices	10
10.	Compression Tools	02
11.	Dampers	05
12.	Lightening Arrester	01
13	Transformer Three phase (oil cooled) 5 K.V.A. 440/220 v	01
14	Transformer oil testing kit, 100 KV	01
15	Conduit pipe cutting and threading machines adjustable	01
16	Conduit pipe bending machine	01
17	Hot Stick	02
18	Soldering iron, 25 W, 65 W	02
19	Moulded Case Circuit Breaker (MCCB) 440V/25A	1
20	Hydraulic crimping tool for UG 20 sq mm to 250sq mm	1
21	Solar street light lamp set 12v , 18 / 24 watts	1 each
22	HPMV Lamp 250 watts	2 Nos
23	HPSV Lamp 250 watts	2 Nos

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: Lineman

LIST OF TOOLS& EQUIPMENTS FOR Lineman 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	16
2.	Set square celluloid 45^0 (250 X 1.5 mm)	16
3.	Set square celluloid 30^0-60^0 (250 X 1.5 mm)	16
4.	Mini drafter	16
5.	Drawing board (700mm x500 mm) IS: 1444	16

B : FURNITURE REQUIRED

Sl. No.	Name of the items	Quantity (indicative)
1	Drawing Board	16
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: Lineman

For Batch of Lineman 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.