# LINEMAN

## COMPETENCY BASED CURRICULUM

**(Duration: 2 Yrs.)**

## APPRENTICESHIP TRAINING SCHEME (ATS)

**NSQF LEVEL- 4**

## SECTOR – Electrical (Including New and Renewable Energy)

सत्यमेव जयते

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

Directorate General of Training

Skill India
कौशल भारत-कुशल भारत

# LINEMAN

**(Revised in 2018)**

## APPRENTICESHIP TRAINING SCHEME (ATS)

## NSQF LEVEL - 4

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**
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1. BBMP, Nangal
2. BBMB Dhulkote
3. NHPC Chamera-1
4. Bangalore Electric Supply Company

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## CONTENTS

# 1. BACKGROUND

## 1.1 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.

## 1.2 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.

## 1.3 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.

# 2. TRAINING SYSTEM

## 2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of NCVT for propagating vocational training.

Lineman trade under ATS is one of the most popular courses delivered nationwide through Electricity Boards. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, while Core area - Workshop Calculation and science, Engineering Drawing and Employability Skills imparts requisite core skills & knowledge and life skills. After passing out the training programme, the trainee is being awarded National Apprenticeship Certificate (NAC) by NCVT having worldwide recognition.

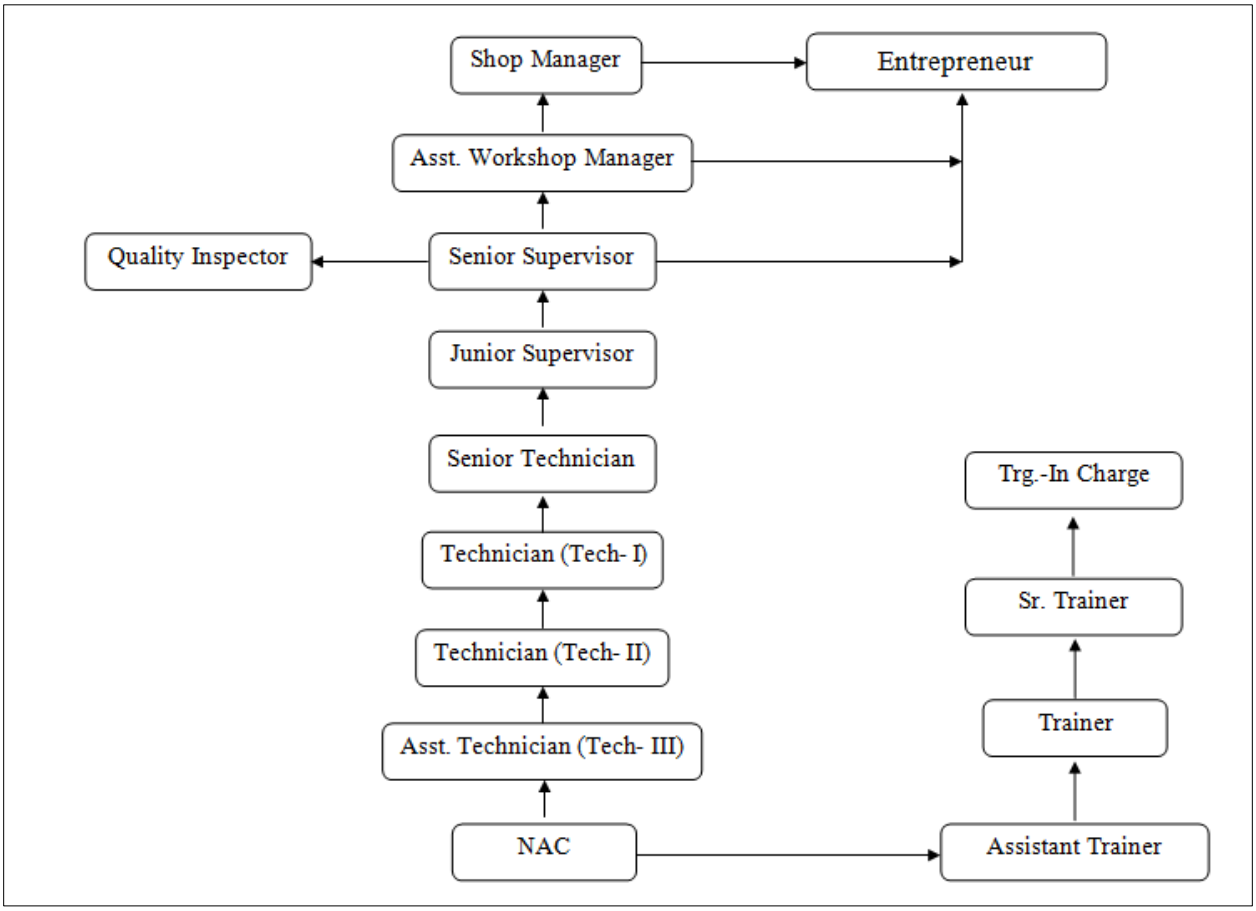
**Broadly candidates need to demonstrate that they are able to:**

- Read & interpret technical parameters/document, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge, core skills & employability skills while performing jobs and solve problem during execution.
- Document the technical parameters related to the task undertaken.

***Lineman***

## 2.2 CAREER PROGRESSION PATHWAYS:

- Indicative pathways for vertical mobility.




## 2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of two years (*Basic Training and On-Job Training*): -

**Total 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** |

## *Lineman*

**A. Basic Training**

For 02 yrs. Course (Engg) :- **Total 06 months:** 03 months in 1st yr. + 03 months in 2nd yr.
For 01 yr. course (Engg) :- **Total 03 months:** 03 months in 1st yr.)

| S No. | Course Element | Total Notional Training Hours | |
|---|---|---|---|
| | | **For 02 Yrs. course** | **For 01 Yr. course** |
| 1. | Professional Skill (Trade Practical) | 550 | 275 |
| 2. | Professional Knowledge (Trade Theory) | 240 | 120 |
| 3. | Workshop Calculation & Science | 40 | 20 |
| 4. | Engineering Drawing | 60 | 30 |
| 5. | Employability Skills | 110 | 55 |
| | **Total (Including internal assessment)** | **1000** | **500** |

**B. On-Job Training:-**

For 02 yrs. Course (Engg) :- **Total 18 months:** 09 months in 1st yr. + 09 months in 2nd yr.

Notional Training Hours for On-Job Training: 3120 Hrs.

For 01 yr. course (Engg) :- **Total 12 months**

Notional Training Hours for On-Job Training: 2080 Hrs.

**C. Total training hours:-**

| Duration | Basic Training | On-Job Training | Total |
|---|---|---|---|
| **For 02 yrs. course** (Engg) | 1000 hrs. | 3120 hrs. | 4120 hrs. |
| **For 01 yr. course** (Engg) | 500 hrs. | 2080 hrs. | 2580 hrs. |

## 2.4 ASSESSMENT & CERTIFICATION:

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by Govt of India from time to time. The Employability skills will be tested in first two semesters only.

a) The **Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training

institute have to maintain individual *trainee portfolio* as detailed in assessment guideline (section-2.4.2). The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NAC will be conducted by NCVT on completion of course as per guideline of Govt of India. The pattern and marking structure is being notified by govt of India from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline (section-2.4.2) before giving marks for practical examination.

## 2.4.1 PASS REGULATION

The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%. The candidate pass in each subject conducted under all India trade test.

## 2.4.2 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 should be given while assessing for team work, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

Evidences of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examination body. The following marking pattern to be adopted while assessing:

***Lineman***

| Performance Level | Evidence |
|---|---|
| (a) Weightage in the range of 60 -75% to be allotted during assessment | |
| For performance in 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. | • Demonstration of good skill in the use of hand tools, machine tools and workshop equipment<br>• Below 70% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards.<br>• A fairly good level of neatness and consistency in the finish<br>• Occasional support in completing the project/job. |
| (b)Weightage in the range of above75% - 90% to be allotted during assessment | |
| 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. | • Good skill levels in the use of hand tools, machine tools and workshop equipment<br>• 70-80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards.<br>• A good level of neatness and consistency in the finish<br>• Little support in completing the project/job |
| (c) Weightage in the range of above 90% to be allotted during assessment | |
| 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. | • High skill levels in the use of hand tools, machine tools and workshop equipment<br>• Above 80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards.<br>• A high level of neatness and consistency in the finish.<br>• Minimal or no support in completing the project. |

## 3. JOB ROLE

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:**

1. **7413.0100- Lineman, Light and Power**
2. **7413.9900- Electrical Line Installers, Repairers and Cable Jointers, Other**

# 4. NSQF LEVEL COMPLIANCE

NSQF level for Electrician (Steel Plant) trade under ATS: **Level 4**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

a. Process
b. Professional Knowledge,
c. Professional Skill,
d. Core Skill and
e. Responsibility.

The Broad Learning outcome of Lineman under ATS mostly matches with the Level descriptor at Level- 4.

The NSQF level-4 descriptor is given below:

| Level | Process Required | Professional Knowledge | Professional Skill | Core Skill | Responsibility |
|---|---|---|---|---|---|
| Level 4 | Work in familiar, predictable, routine, situation of clear choice. | Factual Knowledge of field of Knowledge or study. | Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts. | Language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural environment. | Responsibility for own work and learning. |

## 5. GENERAL INFORMATION

| | |
|---|---|
| **Name of the Trade** | LINEMAN |
| **NCO-2015** | 7413.0100 Lineman, Light and Power,<br>7413.9900 Electrical Line Installers, Repairers and Cable Jointers, Other |
| **NSQF Level** | Level – 4 |
| **Duration of Apprenticeship Training**<br>(Basic Training + On-Job Training) | Two years (02 Blocks each of one year duration). |
| **Duration of Basic Training** | a) Block –I : 3 months<br>b) Block – II : 3 months<br>**Total duration of Basic Training: 6 months** |
| **Duration of On-Job Training** | a) Block–I: 9 months<br>b) Block–II : 9 months<br>**Total duration of Practical Training: 18 months** |
| **Entry Qualification** | 8th Class examination under 10+2 system of education or its equivalent |
| **Selection of Apprentices** | The apprentices will be selected as per Apprenticeship Act amended time to time. |
| **Instructors Qualification for Basic Training** | As per ITI instructors qualifications as amended time to time for the specific trade. |
| **Infrastructure for Basic Training** | As per related trade of ITI |
| **Examination** | The internal examination/ assessment will be held on completion of each block.<br>Final examination for all subjects will be held at the end of course and same will be conducted by NCVT. |
| **Rebate to Ex-ITI Trainees** | 01 year |
| **CTS trades eligible for LINEMAN Apprenticeship** | Wireman |

***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.*
- *For imparting Basic Training the industry to tie-up with ITIs having such specific trade and affiliated to NCVT.*

# 6. LEARNING OUTCOME

## 6.1 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the LINEMEN course of 02 years duration under ATS.

**Block I & II:-**

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*
4. Select and ascertain measuring instrument and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Plan and organize the work related to the occupation.

## 6.2 SPECIFIC LEARNING OUTCOME

**Block – I**

1. Observe & practice safety in all electrical works. Practice providing First Aid.
2. Identify & use all hand tools.
3. Practice of Drilling, Chiselling, Sawing, Filing, Chipping.
4. Practice of different types of welding, Drilling, Chiselling, 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.

**B. BLOCK – II**

21. Observe & practice safety in all electrical works. Practice providing First Aid.
22. Practice to climb & working on Ladders, its operation.
23. Practice to erect different type of pole.
24. Fixing of brackets, stay rod, insulator on pole, Fixing of cross arms on poles.
25. Operation of fuse of all type Circuit Breaker, Isolator & Connection of junction box.
26. Connecting power and control wiring of Diesel Generating set. Operation, operating switch gears, trouble shooting & basic maintenance.
27. Earthling of HT lines with earth plate.
28. Ground wire and Lightening Arrestors of different type at Grid Substation or HT lines.
29. Assisting in stringing of overhead line HT/LT**.**
30. Assisting during erection of towers by Build-up method –Foundation and sequence of operation.
31. Underground cable joining, HT/LT. Testing of underground cables or overhead cable, trouble shooting, Locating faults, open circuit, short circuit & leakage in cables.
32. Operates & maintains transformer substation & equipments like circuit breakers, batteries and other controlling devices.

## *Lineman*

33. Practice to climb on tower and painting of tower after erection to avoid corrosion and dismantling of damage or expired poles/towers.
34. Three phase Transmission and their maintenance, faults location using apparatus and remove fault.
35. Distribution –Three phase three wire, three phases four Wire, Single phase two Wire and three wire.
36. Jumper & Jumper Connections, D-link Gange operated switch, HT blades.
37. Erection and maintenance of pole type transformer and tap changing.
38. Charging or discharging of line using circuit breaker, Isolator.
39. Operation & maintenance of Solar cells and Non conventional energy generation system.
40. Tower and Tower line erection-Foundation and sequence of operations. Mounting cross arm, pins insulator and Damper etc.

***Note:*** *Learning outcomes are reflection of total competencies of a trainee and assessment will be carried out as per assessment criteria.*

# 7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

| GENERIC LEARNING OUTCOME | |
|---|---|
| **LEARNING OUTCOMES** | **ASSESSMENT CRITERIA** |
| 1. Recognize & comply safe working practices, environment regulation and housekeeping. | 1. 1. Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements. |
| | 1. 2. Recognize and report all unsafe situations according to site policy. |
| | 1. 3. Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures. |
| | 1. 4. Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements. |
| | 1. 5. Identify and observe site policies and procedures in regard to illness or accident. |
| | 1. 6. Identify safety alarms accurately. |
| | 1. 7. Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures. |
| | 1. 8. Identify and observe site evacuation procedures according to site policy. |
| | 1. 9. Identify Personal Productive Equipment (PPE) and use the same as per related working environment. |
| | 1. 10. Identify basic first aid and use them under different circumstances. |
| | 1. 11. Identify different fire extinguisher and use the same as per requirement. |
| | 1. 12. Identify environmental pollution & contribute to avoidance of same. |
| | 1. 13. Take opportunities to use energy and materials in an environmentally friendly manner |
| | 1. 14. Avoid waste and dispose waste as per procedure |
| | 1. 15. Recognize different components of 5S and apply the same in the working environment. |

## *Lineman*

| | |
|---|---|
| 2. Understand, explain different mathematical calculation & science in the field of study including basic electrical and | 2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction. |
| apply in day to day work. *[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]* | 2.2 Measure dimensions as per drawing |
| | 2.3 Use scale/ tapes to measure for fitting to specification. |
| | 2.4 Comply given tolerance. |
| | 2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials. |
| | 2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges. |
| | 2.7 Explain basic electricity, insulation & earthing. |
| | |
| 3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]* | 3. 1. Read & interpret the information on drawings and apply in executing practical work. |
| | 3. 2. Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters. |
| | 3. 3. Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work. |
| | |
| 4. Select and ascertain measuring instrument and measure dimension of components and record data. | 4.1 Select appropriate measuring instruments such as micrometers, vernier calipers, dial gauge, bevel protector and height gauge (as per tool list). |
| | 4.2 Ascertain the functionality & correctness of the instrument. |
| | 4.3 Measure dimension of the components & record data to analyse the with given drawing/ measurement. |
| | |
| 5. Explain the concept in productivity, quality tools, and | 5.1 Explain the concept of productivity and quality tools and apply during execution of job. |

| | |
|---|---|
| labour welfare legislation and apply such in day to day work to improve productivity & quality. | 5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws. |
| | 5.3 Knows benefits guaranteed under various acts |
| | |
| 6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources. | 6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution. |
| | 6.2 Dispose waste following standard procedure. |
| | |
| 7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth. | 7. 1. Explain personnel finance and entrepreneurship. |
| | 7. 2. Explain 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. |
| | 7. 3. Prepare Project report to become an entrepreneur for submission to financial institutions. |
| | |
| 8. Plan and organize the work related to the occupation. | 8. 1. Use documents, drawings and recognize hazards in the work site. |
| | 8. 2. Plan workplace/ assembly location with due consideration to operational stipulation |
| | 8. 3. Communicate effectively with others and plan project tasks |
| | 8. 4. Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same. |
| **SPECIFIC OUTCOME** | |
| **Block-I & II (Section:10 in the competency based curriculum)** | |
| *Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under **Block – I& II** (section: 10) must ensure that the trainee works in familiar, predictable, routine, situation of clear choice. Assessment criteria should broadly cover the aspect of **Planning** (Identify, ascertain, etc.); **Execution** apply factual knowledge of field of knowledge, recall and demonstrate practical skill during performing the work in routine and repetitive in narrow range of application, using appropriate rule and tool, complying with basic arithmetic and algebraic principles and language to communicate in written or oral with required clarity; **Checking/ Testing** to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for his/her own work and learning.* | |

# 8. SYLLABUS

## BASIC TRAINING (Block – I)

## Duration: (03) Three Months

| Week No. | Professional Skills (Trade Practical) | Professional Knowledge (Trade Theory) |
|---|---|---|
| 1. | Maintain Safety measures/precautions.<br>Preventive measures for electrical accidents & steps to be taken in such accidents. Demonstration of Types of Fire extinguishers and use of Fire extinguishers.<br>Demonstration of artificial respiration<br>Identification of Trade Hand Tools, proper use, care and maintenance | **Occupational Safety & Health**<br>Basic safety introduction,<br>Personal protection:-<br>Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message.<br>Use of Fire extinguishers.<br>Visit & observation of sections.<br>Artificial Respiration.<br>Demonstration of Trade Hand Tool.<br>Identification of Clamps, Saw, Rivets, Bolts and maintenance of various hand tools. |
| 2 | Familiarization with signs and symbols of Electrical accessories.<br>Study of different types LT/HT symbols, single line diagrams of sub stations<br>Measurement of voltage, current and resistance, Verification of Ohm's law | Fundamental of electricity:<br>Electron theory- free electron,<br>Fundamental terms- Current, Voltage definitions,<br>AC, DC, Phase, Neutral, Earth.<br>Units & effects of electric current.<br>Reading of LT/HT symbols, single line diagrams.<br>Ohms Law and Law of resistance i.e. Series Parallel resistance, Specific resistance. |
| 3 | Practice of Drilling, Chiseling, Sawing, Filing, Chipping.<br>Use of Black Smith Basic Hand Tool<br>Practice of different types of welding and Brazing<br>Use of Sheet metal Workers Hand Tools | Use of LINEMAN & Carpenter Hand Tools<br>Simple Forging & Hardening & Tempering of common smithy Tools<br>Simple Welding and Brazing<br>Simple Cutting, Bending, Jointing |
| 4 | Practice of Joints of Cables or conductor of Single Strands.<br>Practice of different types of Joints of Cables or conductor of multi Strands. | Making Joints using Single Strands Conductor<br>Making Joints using multi Strands Conductor |

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| 5. | Practice of Soldering joints using Aluminum flux and Alca 'P' Solder<br>Practice of Crimp Joints using Aluminum and Copper Conductor<br>Practice to joint cable by removing insulation, armour, jointing of conductors. Cable glanding and termination with TPST switches. | Soldering Joints<br>Use of Crimping tool, wire stripper, different types of lugs.<br>Cable Jointing, cable joining teqniqes, types of cable joining kits and its specifications. |
| 6. | Practice on fixing and connection of plugs, sockets, Lamp holder, regulator , tube light fixture<br>Practice to clamp different conductor, cable | Fixing & Connecting switches<br>Use of clamps |
| 7. | Practice to connect Cut outs in line & uses of Fuses.<br>**Practice on Earthing**- different methods of earthing.<br>Measurement of Earth resistance by earth tester or earth Megger.<br>Testing of Earth Leakage by ELCB and relay. Field Testing of line insulators | Use of Cut outs & Fuses<br>**Earthing**- Principle of different methods of earthing & selection. i.e. Pipe, Plate, etc<br>Importance of Earthing.<br>Improving of earth resistance<br>Earth Leakage circuit breaker (ELCB). |
| 8. | Identification of parts of battery. Practice on Battery Charging, Preparation of Electrolyte, checking specific gravity of Electrolyte,<br>Testing of cells, Installation of batteries, Charging of batteries by different methods.<br>Routine care & maintenance of Batteries<br>Preparing of Electromagnet | **Chemical** effect of electric current-Principle of electrolysis. Faraday's Law of electrolysis<br>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.<br>Sealed Maintenance free Batteries, Solar battery, Load & back up time calculation.<br>Study of Electromagnetic Induction, self induction, mutual induction |
| 9 | Identification of different type of Instruments.<br>Use of -PMMC , MI meter, Multi meter (Digital/Analog) , Wattmeter, P F meter, Energy meter, Frequency meter, | **Electrical Measuring Instruments -**<br>-types, indicating types<br>PMMC & MI meter (Ammeter, Voltmeter)<br>-Range extension<br>-MultiMater(Digital/Analog)<br>-Wattmeter |

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| | Phase sequence meter, Digital Instruments, etc<br>Range selection & Range extension of meters. | - P.F. meter<br>- Energy meter (Digital/analog)<br>–Insulation Tester (Megger), Earth tester.<br>-Frequency meter<br>-Phase Sequence meter<br>-Multimeter –Analog and Digital<br>-Tong tester<br>-Tachometer. |
| | Practice in casing, Capping (PVC) and Conduit wiring.<br>Testing of wiring installation by multi meter, megger. Fixing of calling bells/buzzers.<br>Identification & demonstration on conduits and accessories & their uses, cutting , threading & laying,Installation, Testing, Maintenance and Repairing of wiring.<br>Application of fuses, relay, MCB, ELCB. Fuses, ELCB, MPCB | **Electric wirings**, I.E. rules.<br>Types & selection of wirings both domestic and industrial.<br>Specifications for wiring.<br>Grading of cables and current ratings.<br>Principle of laying out in domestic wiring.<br>Estimate the cost of wiring system<br>Voltage drop concept.<br>**Wiring system -** P.V.C., concealed system.<br>Specifications, standards for conduits and accessories<br>- Power Wiring<br>- Control Wiring<br>- Information Communication<br>- Entertainment Wiring.<br>Testing of wiring installation by megger<br>Study of Fuses, Relays, Miniature circuit breakers (MCB), ELCB, etc. |
| 10. | Practice on Wiring for internal Lighting & External Lighting, power wiring, AEH wiring.<br>Government Specification for **Rural & Urban Area Electrification** | **Layout of Lighting, and Power Circuit.**<br>**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.<br>Connect, start, run and reverse a different type of DC motor. Study of starters for DC motors.<br>load performance test on different types of DC motors & calculation of efficiency. | **D.C. Machines -** General concept of Electrical Machines.<br>**Principle of D.C. generator.** Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring Brushes, Laminated core.<br>Explanation of **D.C. Generators**-types, parts-Practical uses. Description of series, shunt and compound generators and their selection.<br>Types of D. C. Motor.Starters used in D.C. motors |

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| | Speed control of a DC motor by different method.<br>Maintenance, troubleshooting & servicing of DC machines.<br>Overhaul a DC machine. | Types of speed control of DC motors in industry.<br>Application of D.C. motors.<br>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<br>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.<br>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/Examination 03days** | |

**NOTE: -** *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.*

## BASIC TRAINING (Block – II)

## Duration: (03) Three Months

| Week No. | Professional Skills (Trade Practical) | Professional Knowledge (Trade Theory) |
|---|---|---|
| 1. | Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message.<br>Preventive measures for electrical accidents & steps to be taken in such accidents.<br>Use of Fire extinguishers.<br>Identify different hand tools and their uses during working on line. | Recognize & comply safe working practices, environment regulation and housekeeping.<br>Demonstration of Lineman Hand Tools. |
| 2. | Practice to climb & working on Ladders, its operation.<br>Practice to erect pole. | Uses of Ladders, Draw vice.<br>Erecting of poles. |
| 3. | Identify different insulators and practice to fix on pole.<br>Fixing of cross arms on poles<br>Uses of pulley block & lifting tackles during erection or maintenance of poles/tower. | Types of Insulators i.e. pin, disc, suspension Strain etc<br>Use of cross Arm<br>Pulley blocks and Lifting tackles |
| 4. | Schematic of a overhead and domestic service line.<br>Prepare layout plan and single line diagram of transmission /Distribution system.<br>Trouble shooting and servicing of LT/HT circuit breaker.<br>Connect feeder cable/ service line to the bus bar.<br>Thermal classification of insulating materials.<br>**Fixing of Stay Rod and brackets on poles** | **POWER GENERATION :**<br>Various ways of electrical power generation. Thermal, Hydro electric, Nuclear, Non-Conventional<br>**Overhead Lines**:<br>Main components of overhead lines-<br>Types of power line Low voltage line medium Voltage line & high voltage line<br>Voltage standard (LV, HV, EHV)<br>Conductor materials, line supports, Insulators, types of Insulators<br>Use of Stay Rod, brackets. |

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| 5. | Identification of parts and terminals of Alternator. Connection, starting, running of Alternator. Practice on alternators, voltage Building,, Parallel operation & load sharing.<br>Practice on installation, running and maintenance of Alternators.<br>**Earthling of HT lines/transformer with earth plate & practice.** | **Alternator**<br>Explanation of alternator, working principle, voltage build-up, loading, Regulation. Types of prime mover, phase sequence, Parallel operation & load sharing.<br>Specification of alternators.<br>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.<br>Connection of Meter at consumer end and connection on pole of service line on pole. | Use of Lightening Arrestors<br>Wiring & Installation of KWH Meter |
| 7. | Laying of low tension UG cable for distribution purpose.<br>Planning of overhead line, marking poles, type of insulator required, and stringing mechanism involved.<br>Practice on Wire joint for different type of conductors. | Laying of underground Cables<br>Layout and stringing overhead lines.<br>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.<br>Parameter used in erecting line.<br>Locating and staking line | Tower Erecting<br>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.<br>Testing of Dielectric strength of Transformer oil using oil Testing Kit<br>Use of ACB, OCB,SF6 Circuit Breaker, Isolator in line and alarm | Pole type Transformer and tap changing gear<br>Transformer oil and its Testing<br>Types of Circuit Breaker, Isolator and alarms.<br>Dual incoming supply, Bus coupler |

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| 11 | Operation & maintenance of indoor & outdoor substation.<br>Detection of faults using apparatus and remove fault. Connection of junction box.<br>Practice to work on hot line (HT lines) using apparatus of protection. | Knowledge of indoor & outdoor substation<br>Detection of faults, Junction Boxes in line Hot line operation. |
| 12 | Practice to fit different dampers on lines<br>Practice to connect or disconnect transformer, apply fuse to transformer and maintenance of transformer | Use of Dampers.<br>Transformers connections, STAR and DELTA, protective devices. |
| 13. | Towers-rigid and Flexible, Mounting cross Arms, pin/disc insulator etc..<br>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** | |

**NOTE: -** *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.*

## 9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

| Block – I | | |
|---|---|---|
| **Sl. No.** | **Workshop Calculation and Science (Duration: - 20 hrs.)** | **Engineering Drawing (Duration : - 30 hrs.)** |
| 1. | **Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units | **Engineering Drawing: Introduction and its importance**<br>Viewing of engineering drawing sheets.<br>- Method of Folding of printed Drawing Sheet as per BIS SP:46-2003<br>**Drawing Instruments** : their Standard and uses<br>- 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 |
| 2. | Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals | **Lines :**<br>- Definition, types and applications in Drawing as per BIS SP:46-2003<br>- Classification of lines (Hidden, centre, construction, Extension, Dimension, Section)<br>- Drawing lines of given length (Straight, curved)<br>- Drawing of parallel lines, perpendicular line<br>- Methods of Division of line segment |
| 3. | **Percentage** : Introduction, Simple calculation | **Drawing of Geometrical Figures**: Definition, nomenclature and practice of -<br>- Angle: Measurement and its types, method of bisecting.<br>- Triangle -different types<br>- Rectangle, Square, Rhombus, Parallelogram.<br>- Circle and its elements |
| 4. | **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 | **Lettering and Numbering** as per BIS SP46-2003:<br>- Single Stroke, Double Stroke, inclined, Upper case and Lower case. |
| 5. | | **Free Hand sketch:** Hand tools and measuring instruments used Electrician/ Wireman/ Lineman trade<br><br>Free hand sketch of wire joints. |

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

## 9.2 EMPLOYABILITY SKILLS

**(DURATION: - 110 HRS.)**

| **Block – I**<br>**(Duration – 55 hrs.)** | |
|---|---|
| **1. English Literacy**<br>Duration : 20 Hrs. | Marks : 09 |
| **Pronunciation** | Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech) |
| **Functional Grammar** | Transformation of sentences, Voice change, Change of tense, Spellings. |
| **Reading** | Reading and understanding simple sentences about self, work and environment |
| **Writing** | Construction of simple sentences Writing simple English |
| **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. |
| **2. I.T. Literacy**<br>Duration : 20 Hrs. | Marks : 09 |
| **Basics of Computer** | Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer. |
| **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. |
| **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.<br>Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets. |
| **Computer Networking** | Basic of computer Networks (using real life examples), Definitions of |

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| **and Internet** | Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks),<br>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.<br>Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes. |
| **3. Communication Skills**<br>Duration : 15 Hrs. Marks : 07 | |
| **Introduction to Communication Skills** | Communication and its importance<br>Principles of Effective communication<br>Types of communication - verbal, non verbal, written, email, talking on phone.<br>Non verbal communication -characteristics, components-Para-language<br>Body language<br>Barriers to communication and dealing with barriers.<br>Handling nervousness/ discomfort. |
| **Listening Skills** | Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.<br>Triple- A Listening - Attitude, Attention & Adjustment.<br>Active Listening Skills. |
| **Motivational Training** | Characteristics Essential to Achieving Success.<br>The Power of Positive Attitude.<br>Self awareness<br>Importance of Commitment<br>Ethics and Values<br>Ways to Motivate Oneself<br>Personal Goal setting and Employability Planning. |
| **Facing Interviews** | Manners, Etiquettes, Dress code for an interview<br>Do's & Don'ts for an interview. |
| **Behavioral Skills** | Problem Solving<br>Confidence Building<br>Attitude |
| **Block – II**<br>**Duration – 55 hrs.** | |

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| **4. Entrepreneurship Skills**<br>Duration : 15 Hrs. | Marks : 06 |
| **Concept of Entrepreneurship** | Entrepreneur - 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. |
| **Project Preparation & Marketing analysis** | Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix. |
| **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. |
| **Investment Procurement** | Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes. |
| **5. Productivity**<br>Duration : 10 Hrs. | Marks : 05 |
| **Benefits** | Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard. |
| **Affecting Factors** | Skills, Working Aids, Automation, Environment, Motivation - How improves or slows down. |
| **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. |
| **Personal Finance Management** | Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance. |
| 6**. Occupational Safety, Health and Environment Education**<br>Duration : 15 Hrs. | Marks : 06 |
| **Safety & Health** | Introduction to Occupational Safety and Health importance of safety and health at workplace. |
| **Occupational Hazards** | Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention. |

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| **Accident & safety** | Basic principles for protective equipment.<br>Accident Prevention techniques - control of accidents and safety measures. |
| **First Aid** | Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person. |
| **Basic Provisions** | Idea of basic provision legislation of India.<br>safety, health, welfare under legislative of India. |
| **Ecosystem** | Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance. |
| **Pollution** | Pollution and pollutants including liquid, gaseous, solid and hazardous waste. |
| **Energy Conservation** | Conservation of Energy, re-use and recycle. |
| **Global warming** | Global warming, climate change and Ozone layer depletion. |
| **Ground Water** | Hydrological cycle, ground and surface water, Conservation and Harvesting of water. |
| **Environment** | Right attitude towards environment, Maintenance of in -house environment. |
| **7. Labour Welfare Legislation**<br>Duration : 05 Hrs. | Marks : 03 |
| **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. |
| **8. Quality Tools**<br>Duration : 10 Hrs. | Marks : 05 |
| **Quality Consciousness** | Meaning of quality, Quality characteristic. |
| **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. |
| **Quality Management System** | Idea of ISO 9000 and BIS systems and its importance in maintaining qualities. |
| **House Keeping** | Purpose of House-keeping, Practice of good Housekeeping. |
| **Quality Tools** | Basic quality tools with a few examples. |

# 10. DETAILS OF COMPETENCIES (ON-JOBTRAINING)

## BROAD LEARNING TO BE COVERED IN INDUSTRY FOR LINEMAN TRADE:

2. Safety and best practices of working with HT/LT supply.
3. Record keeping and documentation
4. Making different types of Joints of Cables or conductor of Single or multi Strands and soldering.
5. Practice of Jumper and Jumper connections
6. Crimping of different types of cables & conductors. Providing glands and connections
7. Earthing: Installation, testing and Maintenance
8. Operation & maintenance of Transformer substation, circuit breakers, batteries etc
9. Distribution system-Feeders, Distribution centre, Primary mains, Secondary mains
10. Erection of tower /pole, climbing & working on them.
11. Fixing of brackets, stay rod, insulator on pole, Fixing of cross arms on poles
11. Stringing of overhead line HT/LT
12. Over head and Underground cables HT/LT.: Joining, Testing, Locating faults trouble shooting.
13. Tower and Tower line erection-Foundation and sequence of operations. Mounting cross arm, pins insulator and Damper etc

***Note:*** *Actual training will depend on the existing facilities available in the establishments.*

The **competencies/ specific outcomes** on completion of On-Job Training are detailed below: -

## Block – I

1. Observe & practice safety in all electrical works (HT/LT). 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.

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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.

## B. BLOCK – II

21. Observe & practice safety in all electrical works (HT/LT). Practice providing First Aid.
22. Practice to climb & working on Ladders, its operation.
23. Practice to erect different type of pole.
24. Fixing of brackets, stay rod, insulator on pole, Fixing of cross arms on poles.
25. Operation of fuse, all type Circuit Breaker, Isolator & Connection of junction box.
26. Connecting power and control wiring of Diesel Generating set. Operation, operating switch gears, trouble shooting & basic maintenance.
27. Earthling of HT lines with earth plate.
28. Ground wire, Lightening Arrestors of different type at Grid Substation or HT lines.
29. Assisting in stringing of overhead line HT/LT**.**
30. Assisting during erection of towers by Build-up method –Foundation and sequence of operation.
31. Underground cable joining, HT/LT. Testing of underground cables or overhead cable, trouble shooting, Locating faults, open circuit, short circuit & leakage in cables.
32. Operates & maintains transformer substation & equipments like circuit breakers, batteries and other controlling devices.
33. Practice to climb on tower and painting of tower after erection to avoid corrosion and dismantling of damage or expired poles/towers.
34. Three phase Transmission and their maintenance, faults location using apparatus and remove fault.
35. Distribution –Three phase Three wire, Three phase four Wire, Single phase two Wire and three wire.

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36. Jumper & Jumper Connections, D-link Gang operated switch ,HT blades
37. Erection and maintenance of pole type transformer and tap changing.
38. Charging or discharging of line using circuit breaker, Isolator.
39. Operation & maintenance of Solar cells & Non conventional energy generation system.
40. Tower and Tower line erection-Foundation and sequence of operations. Mounting cross arm, pins insulator and Damper etc.

**Note:**

1. Industry must ensure that above mentioned competencies are achieved by the trainees during their on job training.
2. In addition to above competencies/ outcomes industry may impart additional training relevant to the specific industry.

## ANNEXURE – I

| LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices) | | |
|---|---|---|
| **A. TRAINEES TOOL KIT ( For each additional unit trainees tool kit Sl. 1-18 is required additionally)** | | |
| **Sl. no.** | **Name of the Tool &Equipments with Specifications** | **Quantity** |
| 1. | 10”Adjustable Wrench | 21 |
| 2. | 12”Adjustable Wrench | 21 |
| 3. | Adjustable spanner, 150mm, 300mm | 21 |
| 4. | Box spanner set. | 21 |
| 5. | Nut Bolt Bag | 21 |
| 6. | Tools Bag (Electrician Tool kit) | 21 |
| 7. | Chisel (Cold and firmer) | 21 |
| 8. | Hack saw frame 200 mm & 300 mm adjustable | 21 |
| 9. | Cutting Plier Heavy duty | 21 |
| 10. | Screw Driver Insulated 250 mm | 21 |
| 11. | Screw Driver Insulated 250 mm Heavy duty | 21 |
| 12. | Power Tester (Neon tester) | 21 |
| 13. | Ball Pen Hammer | 21 |
| 14. | Pole Climber | 21 |
| 15. | Cuff Work Gloves(High Tension) | 21 |
| 16. | Safety Belt | 21 |
| 17. | Safety helmet | 21 |
| 18. | Cuff Work Gloves | 21 |
| 19. | Channel Lock Plier | 21 |
| 20. | protective blankets | 16 |
| 21. | rubber gloves, protective blankets | 21 |
| **B : INSTRUMENTS & GENERAL SHOP OUTFIT** | | |
| 1. | Blow lamp, 0.5 ltr | 01 |
| 2 | Melting pot | 01 |

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| 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) | 2 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 |

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| | | |
|---|---|---|
| 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 types |
| 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 with Specifications** | | |
| 1. | DC Motor 05 KVA | 01 |
| 2 | Types of Pole | As required |
| 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 |

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| | | |
|---|---|---|
| 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. |

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INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

**TRADE: LINEMAN**

**LIST OF TOOLS& EQUIPMENTS FOR -20APPRENTICES**

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

**2) Infrastructure:**

| **A : TRAINEES TOOL KIT:-** | | | |
|---|---|---|---|
| **Sl. No.** | **Name of the items** | **Specification** | **Quantity** |
| 1. | Draughtsman drawing instrument box | | 21 set |
| 2. | Set square celluloid $45^o$ (250 X 1.5 mm) | | 21 set |
| 3. | Set square celluloid $30^o$-$60^o$ (250 X 1.5 mm) | | 21 set |
| 4. | Mini drafter | | 21 set |
| 5. | Drawing board (700mm x500 mm) IS: 1444 | | 21 set |
| **B : Furniture Required** | | | |
| **Sl. No.** | **Name of the items** | **Specification** | **Quantity** |
| 1. | Drawing Board | | 21 |
| 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 |

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| TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS | | |
|---|---|---|
| **Sl. No.** | **Name of the Equipment** | **Quantity** |
| **1.** | Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software | 10 Nos. |
| **2.** | UPS - 500VA | 10 Nos. |
| **3.** | Scanner cum Printer | 1 No. |
| **4.** | Computer Tables | 10 Nos. |
| **5.** | Computer Chairs | 20 Nos. |
| **6.** | LCD Projector | 1 No. |
| **7.** | White Board 1200mm x 900mm | 1 No. |
| ***Note: - Above Tools & Equipments not required, if Computer LAB is available in the institute.*** | | |

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## FORMAT FOR INTERNAL ASSESSMENT

| | | | |
|---|---|---|---|
| **Name & Address of the Assessor :** | | | **Year of Enrollment :** |
| **Name & Address of ITI (Govt./Pvt.) :** | | | **Date of Assessment :** |
| **Name & Address of the Industry :** | | | **Assessment location: Industry / ITI** |
| **Trade Name :** | **Semester:** | | **Duration of the Trade/course:** |
| **Learning Outcome:** | | | |

| **Sl. No** | **Candidate Name** | **Father's/Mother's Name** | Safety consciousness (15) | Workplace hygiene (5) | Attendance/ Punctuality (10) | Ability to follow Manuals/ Written instructions (5) | Application of Knowledge (10) | Skills to handle tools & equipment (10) | Economical use of materials (5) | Speed in doing work (10) | Quality in workmanship (15) | VIVA (15) | **Total internal assessment Marks** | **Result (Y/N)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | | | | | | | | | | | | | | |
| **2** | | | | | | | | | | | | | | |

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