ELECTRICIAN (MINES)

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5

SECTOR – ELECTRICAL (INCLUDING NEW AND RENEWABLE ENERGY)

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

ELECTRICIAN (MINES)

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
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Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

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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.

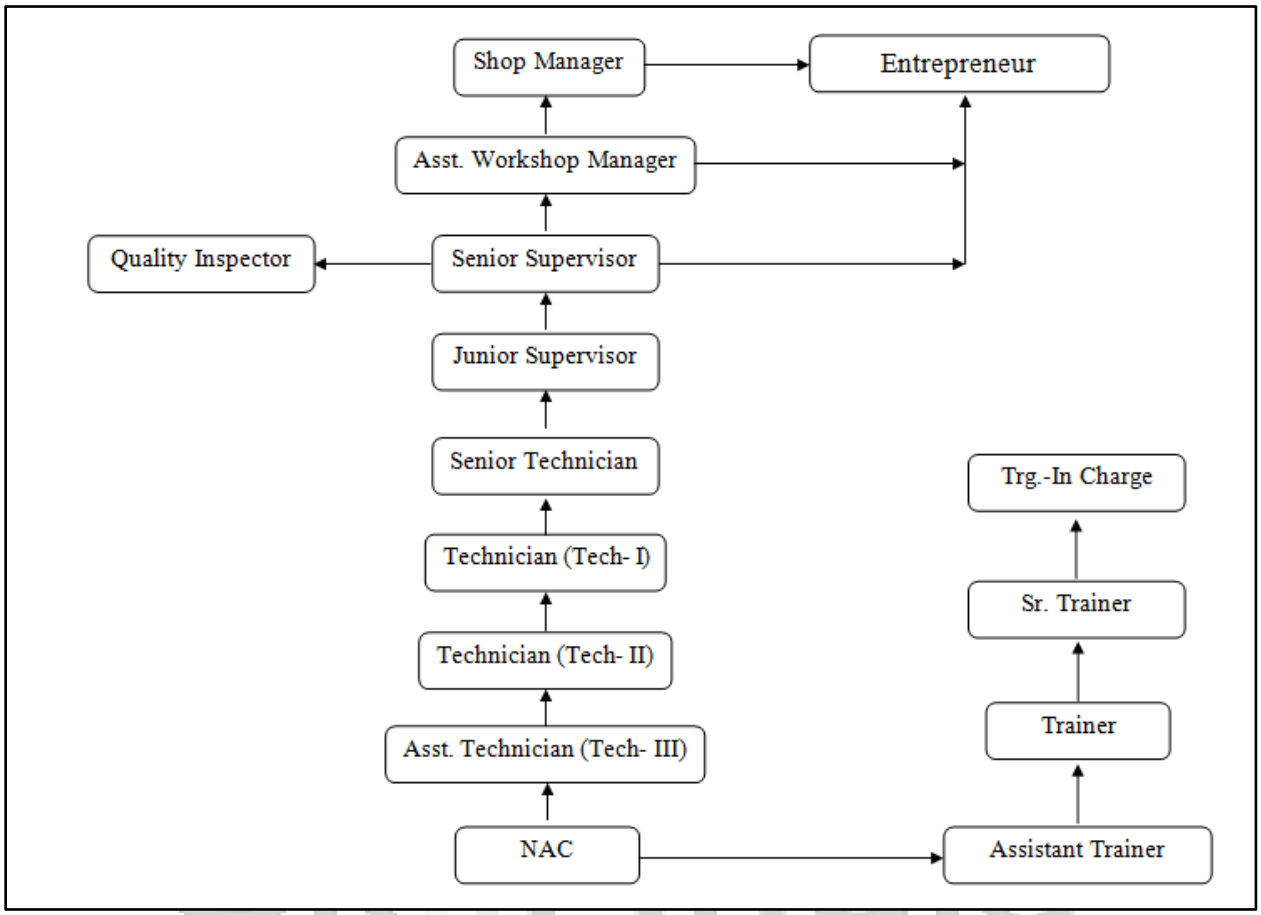
Electrician (Mines) trade under ATS is one of the most popular courses delivered nationwide through Electricity Boards. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, 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.

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**

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:

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 • Below 70% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • 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	
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 • 70-80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • 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	
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 • Above 80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief description of Job roles:

Electrician (Mines) studies the details of the mines and relevant drawing, etc. to determine the electrical circuits, installation details, etc. Installs in mines, lights and switches, motors, transformers, switchgears, switch board fittings and lighting fixtures whether flame proof or not within the mine or relating to the mines. Maintains and repairs the electrical machinery equipment, cap lamps, other fittings in mines, etc. Tests the electrical installations and equipment as prescribed under the mines regulations and Indian Electricity Rules. Locates the faults using megger, test lamp, etc. Repairs defective wiring, burnt out fuses and defective parts and keeps fittings and fixtures in working order. Operates or maintains electrical motors, pumps, etc. including those which are in flame proof fitting, intrinsically safe apparatus, etc. Conversant with general rules of maintenance of the electrical equipment and wiring as per the mines regulations and Indian Electricity Rules. Knows how to test for methane gas and able to switch off electricity from the concerned part of the mine where percentage of methane gas is more than 1.25%. Observes all safety precautions on the switching side avoiding sparking. Knows conversion of AC and DC; conversant with the electrical hazards within the mines. He is also responsible for thorough examination of all apparatus (including the testing of conductors and metallic coverings for continuity) as often as may be necessary to prevent danger, examination and testing of all apparatus erected or re-erected in the Mine before it is put into service in a new position. He is personally responsible for the maintenance at the mine of a log-book made up of daily log sheets prepared in the prescribed form.

Electrician, General installs, maintains and repairs electrical machinery equipment and fittings in factories, workshops power house, business and residential premises etc., Studies drawings and other specifications to determine electrical circuit, installation details, etc. Positions and installs electrical motors, transformers, switchgears. Switchboards, Microphones, loud-speakers and other electrical equipment, fittings and lighting fixtures. Makes connections and solders terminals. Tests electrical installations and equipment and locates faults using megger, test lamps etc. Repairs or replaces defective wiring, burnt out fuses and defective parts and keeps fittings and fixtures in working order. May do armature winding, draw wires and cables and do simple cable jointing. May operate, attend and maintain electrical motors, pumps etc.

Reference NCO 2015:

i) 7411.0200 Electrician (Mines)
ii) 7411.0100 Electrician, General

4. NSQF LEVEL COMPLIANCE

NSQF level for Electrician (Mines) trade under ATS: **Level 5**

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 Electrician (Mines) under ATS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 5	Job that requires well developed skill, with clear choice of procedures in familiar context.	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problem by selecting and applying basic methods, tools, materials and information.	Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication .	Responsibility for own work and Learning and some responsibility for other's works and learning.

5. GENERAL INFORMATION

Name of the Trade	Electrician (Mines)
NCO-2015	7411.0200 Electrician (Mines) 7411.0100 Electrician, General
NSQF Level	Level – 5
Duration of Apprenticeship Training (Basic Training + On-Job Training)	Two years (02 Blocks each of one year duration).
Duration of Basic Training	a) Block –I : 3 months b) Block – II : 3 months **Total duration of Basic Training: 6 months**
Duration of On-Job Training	a) Block–I: 9 months b) Block–II : 9 months **Total duration of Practical Training: 18 months**
Entry Qualification	Pass in 10th class examination under the 10+2 System of education with Science or its equivalents.
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. 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 ELECTRICIAN (MINES) Apprenticeship	Electrician

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 Electrician (Mines) 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. Use of Electricians basic hand tools.
2. Make joints using single strand cables.
3. Make joints using multi strand cables.
4. Use of Switches, plugs, sockets, etc.
5. Use of cut-out, fuses, regulators, test lamps, etc.
6. Make electrical circuits on wooden boards.
7. Use of electrical meters including electronics and digital instruments.

8. Install and test of light and power, circuits in casting and capping, TRS & PCV cables.
9. Use of megger, earth resistance meter, condenser wire gauge, tachometer etc.
10. Locate and rectify faults in simple circuits.
11. Knowledge of working at height.
12. Operate and maintain AC/ DC motors and starters.
13. Know about Cable jointing, soldering, insulating etc.
14. Identify the electrical equipment requirements as per the specifications in the work instructions for installation of electrical substations/ electrical equipment/ electrical wiring or fixtures.
15. Winding of low and medium voltage armatures, field coils and starters.
16. Knowledge of distribution of fuse boxes and use of growlers and soft insulation.
17. Knowledge of gas discharge and GLS lamps.
18. Knowledge of intermediate and drum switches.

B. Block – II

19. Electrical installation and erection of machines.
20. Running, Care and maintenance :
    a. Ac motors and starters given types Applied to the present industrial equipment electronic hydraulic, pneumatic controls fitted with the various machines, etc. and electronics
    b. DC motors and starters- Given types
21. Make a buzzer/ electric bell/ transformer.
22. Rewinding of small power transformer.
23. Test and rectify faults in M-G. Set rotary converter and rectifier.
24. Knowledge of testing and repair of alternators, generators, electrical machines and electronic controls.
25. Testing of mine gases- Use of instruments and apparatus for detection of mine gases. Construct and assemble flame safety lamp, detection of mine gases construction and fire-damp by flame safety lamp.
26. Industrial switch board work.
27. Wiring in mines.
28. Lay shaft cables.
29. Install mine lights and switches and maintenance of cap lamps and chargers.
30. Study of different types of mining cables.
31. Cable lying with joints and termination including filling of compounds, supporting cables in mines. Care and maintenance of cables.
32. Locate and rectify faults in electrical equipment e.g. drill transformers, gate box, starters, mines locatives etc. with special attention to safety signals.
33. Install and maintain electrical equipment in long wall mining.

34. Maintain electrical motors with special reference to flame proof enclosure.
35. Maintain circuit breakers and protective gears.
36. Use and maintain intrinsically safe apparatus.
37. Install and maintain bell circuit, telephone circuit, signalling circuit including shaft signals and electronic circuits.
38. Familiarise with the working of surface and underground substations.

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.

2. Understand, explain different mathematical calculation & science in the field of study including basic electrical and 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]*	2.1 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.
	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 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 labour welfare legislation and apply such in day to day work to improve productivity & quality.	5.1 Explain the concept of productivity and quality tools and apply during execution of job.
	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 & block – II** (section: 10) must ensure that the trainee achieves well developed skill with clear choice of procedure in familiar context. Assessment criteria should broadly cover the aspect of **Planning** (Identify, ascertain, estimate etc.); **Execution** (perform, illustration, demonstration etc. by applying 1) a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information 2) Knowledge of facts, principles, processes, and general concepts, in a field of work or study 3)Desired Mathematical Skills and some skill of collecting and organizing information, communication) and **Checking/ Testing** to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.*	

8. SYLLABUS

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1-2	• Implementation of various safety measures in the shop floor. • Visit to different sections of the Institute. • Demonstration of elementary first aid. Artificial Respiration. • Practice on use of fire extinguishers. • Occupational Safety & Health. • Importance of housekeeping & good shop floor practices. • Health, Safety and Environment guidelines, legislations & regulations as applicable. • Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction, **Personal protective Equipment (PPE):-** • Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. • Preventive measures for electrical accidents & steps to be taken in such accidents. • Use of Fire extinguishers. **Safe Handling of electrical appliances used in mines** • Handle lamps, holder switches etc used in mines. • Apply standard voltages applicable in mine. • Handle trailing cables and sockets • Safety measures in earth testing,	**Occupational Safety & Health** Basic safety introduction, Personal protection:- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Use of Fire extinguishers. Visit & observation of sections. Various safety measures involved in the Industry. Elementary first Aid. Concept of Standard **Soft Skills**: its importance and Job area after completion of training. Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies eg; power failure, fire, and system failure. Mines safety legistations- safety at work-code to conduct in mines. Mine gases- fire damp, after damp, carbon monoxide, carbon dioxide etc. Their physiological effects, means of detection and testing. Oxygen- effects of deficiency of oxygen in mine atmosphere and care therein. Ignition, explosion of fire damp and coal dust. Indian Electricity Act and Rules applicable to the mines.

	insulation testing of cables and other electrical equipments. • Flame proof protection: flame proof enclosures; intrinsically safe circuits. • Safety of flame proof apparatus/ equipment used in mines including motors, generators, starters, controllers, switch gears, O.C.Bs etc.	
3	• Familiarization with signs and symbols of Electrical accessories. • Demonstration of trade hand tools. • Use, care & maintenance of various hand tools. • Practice on installation and overhauling common electrical accessories as per simple Electrical circuit / Layout. • Make test board.	Description, specification and general care and maintenance of common hand tools identification and measurement of bolts, nuts and screw. Electron theory miniature solar system elements atom and free electron. Fundamental terms definition, units etc effects of electric currents
4-5	• Identify good electrical conductors • Use insulated conductors • Use of wire gauge and insulated conductors • Verification of laws of series and parallel circuits. • Experiment on poly phase circuits. • Current, voltage, power and power factor measurement in single & poly-phase circuits. • Measurement of energy in single and poly-phase circuits. • Use of phase sequence meter. • Identification of parts of battery. • Practice on Battery Charging, Preparation of battery charging. • Testing of cells, Installation of batteries, Charging of batteries by different methods. • Routine care & maintenance of Batteries.	Qualities of good electrical conductors, common conductors their shape, size and use of wire gauge etc. Insulated conductor in general use – their kinds as regards insulation and voltage, Grades low medium and high voltage. Soldering, its purpose, different percentage of solder used. Use of flux. Different fluxes for different purpose or metals, use of resin and core solder. Description of soldering equipment. Care and maintenance of the blow lamp. Common electrical accessories, specification and common insulating materials used. Ohm's law and its application. Series connection of appliances of resistances. Characteristics and uses. Use of voltmeter and Ammeter. Different types of resistances parallel circuit, its characteristics and application, use of protective devices like fuses, earthing, etc. Precautions in using aluminium conductor cable Work, power and energy their inter-relation calculation of power and energy

		in electrical circuits. Ohm's law. Simple problems. Chemical effect of electric current, principle of electro electrolysis, Faradays law of electrolysis. Electro chemical equivalent,. Values of E.C,E. for different electrolytes. Explanation of Anode, Cathode, etc. Introduction of fitting trade, safety precautions to be observed. Description of files, hammers, chisels, hacksaw frames, blades their specification and grades, care and maintenance of steel rule, Try- square and files. Lead acid cell, description of parts. Methods of charging precautions: to be taken and testing equipment. General defect and remedies of lead acid cells. General maintenance and up keep of lead acid cells, and nickel-alkaline cells. General idea of growing importance of alternating current system with suitable example.
6-7	• Skinning the cables. • Demonstration & Practice on bare conductors joints--such as rat tail, Britannia, straight, Tee, Western union Joints. • Practice in soldering & brazing. • Practice on crimping thimbles, Lugs. • Demonstration and identification of types of cables. • Demonstration & use on using standard wire gauge & micrometer.	Description of M.S. tinned and galvanised sheets and their advantages. Soldering materials fluxes and process of soldering methods of jointing and soldering Magnetism – terms, used, types and shapes of magnets, properties of magnets, general care and maintenance, methods of magnetizing. Magnetic materials. Electromagnet, advantages and uses, Principle of electromagnetism, cork, screw rule, right hand thumb rule, magnetic field of current carrying conductor and loop, earth magnetism, solenoid and its polarity palm rule etc. Magnetic terms and equations. Method of changing polarity of Poleroid. Principle of electromagnetic induction, Faraday law, Lenz's law- resistance variation of resistance with temperature,

		material, cross section and length. Principle of DC generator- Flaming's right hand rule. Use of slip rings and split rings and the function of commutator
8	• 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. • Load performance test on different type of DC motor& calculation of efficiency. • Speed of a DC motor by different method. • Maintenance, troubleshooting & servicing of DC machines. Overhaul a DC machine. • Demonstration of trade hand tools. • Use, care & maintenance of various hand tools. • Practice on installation and overhauling common electrical accessories as per simple Electrical circuit / Layout. • Make test board.	Parts and function of DC generator, E.M.F equation self and separately excited generators, their application in practical field. Used of megger. Type and characteristics of DC generators such as series, shunt and compound, their application. Simple problems on electrical circuit. Making a circuit diagram Terms used in DC motor such as Torque, speed, back E.M.F. etc. their relation and practical applications. Electromagnetic drag. Flaming's Left hand rule. Principle of DC Motor. Types & characteristics of DC motors. Industrial application of DC motor. Starting methods. Methods of controlling speed of DC motors- their advantages and disadvantages and industrial application DC winding terms: Introduction, winding terms such as lap winding, wave winding, pole pitch, coil- pitch or back pitch, front, pitch resultant pitch, progressive and retrogressive winding. Simple problems on electronic and electrical circuit. Making a circuit diagram. More stress to be given in electronic circuit (diagram symbols). Armature – reaction used of interpoles and their polarity, connection of interpoles. Principles and description of Voltage cell; defects and remedies of Leclanche cell and Dry cell description advantages, use, care and maintenance. Grouping of cells for different voltage and current.

9-10	• Use of alternators • Load performance of different types of alternators • Calculation of regulation & efficiency. • Maintenance, troubleshooting & servicing of alternators • Different types of transformers and their use. • Identify different types of torques.	Alternators, parts emf equation, regulation, phase sequence. Transformers- construction, working principle, cooling method. Conduit capacities and I.E. Rules pertaining to conduit pipe installations with electronic panel control diagram Single phase motors. Split phase, capacitors, Repulsion and series motor working principle, parts & characteristics. Starters Types and characteristics. Using electronic data symbols etc. with circuit diagram. Single phase motors. Split phase, capacitors, Repulsion and series motor working principle, parts & characteristics. Starters Types and characteristics
11	• Knowledge of MC and MI type meters • Winding factor with Kw, pitch factor with Kp and distribution factor. • Calibration of Moving Coil, ammeter, voltmeter. • Measure and Calculate Input impedance of dynamometer • Check and Calibrate dynamo type instrument.	Electric Instruments: Classification as regards force employed, etc. constructional details of M.C. and M.I. type meters. Dynamometers and Hot wire instrument. Constructional details of Energy meter and Megger. Use of shunt and multiplier. Principles & use of C. T. & P.T. Also electronic and digital instruments and their correct use AC winding terms: AC armature winding terms- coil side, coil end, coil leads, coil group, and connections. Adjacent pole connected armature winding and alternate pole connected armature winding', lap and wave connected Coil round armature according to their shapes and an arrangement- single and multi-coils. Mercury vapour and sodium vapour lamp construction characteristics and wattage available. Fluorescent tube construction, characteristic, size and wattage available. Types of lighting
12	• Various types of switches and switch gears • Various types of wiring.	Conduit and concealed wiring. Use of flame proof and explosion proof switch gear as applied to the industry.

	• Use of flame proof switch gear • Identify explosion proof switch gear	
13	**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.*

BASIC TRAINING (Block – II)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1-2	• Verification of Ohm's Law, Measuring unknown resistance. • Verification of laws of series and parallel circuits. • Experiment on poly phase circuits. • Current, voltage, power and power factor measurement in single & poly-phase circuits. • Measurement of energy in single and poly-phase circuits. • Use of phase sequence meter. • Use of multimeter	Resistance in Ac circuit. The resistance, phase relationship, effect of frequency power in resistance circuit, inductance in AC circuit. An indicator, the unit of inductance, inductive reactance, effect of frequency, inductors connected in series and parallel, phase relationship and power in inductive circuit. Capacitance in AC circuit. A capacitor, the unit of capacitance, capacitive reactance, effect of frequency, capacitors connected in series and parallel, phase relationship and power in capacitive circuit. More emphasis to be given in electronics controls, symbols circuits and instruments, use etc. Series and Parallel AC circuit R&X in series, R&C in series, R,X and C in series, power in the circuit, power factor. Poly phase circuit. Advantage of poly phase over single, two and three phase working power measurement. Method of improving power factor.
3	• Identification of types of transformers. • Connection of transformers, Transformation ratio, testing of transformer, calculates the losses & efficiency. • Use of Current Transformer (C.T.) and Potential (Voltage) transformer (P.T.). • Testing of single phase and Three Phase Transformers -. • Cleaning, maintenance, testing and changing of oil.	Alternator: Parts of an alternator, E.M.F. equation, rating of alternators and prime mover. Automatic regulation of AC generators. Synchronising of alternators (Dark Lamp Bright Lamp and synchroscope method). Introduction to transformers, its theory and application. Transformer losses, methods of finding out these losses and calculating efficiency. Transformer Construction: Transformer cores, winding, shielding and auxillary parts including breathen, conservator and buchltz protective device. Types of

		transformer. (Power, auto and instrument transformers). Paralleling of transformers.
4-6	• Identification of parts and terminals of AC motors. • Connection, starting, running of AC motors using Starters. Load test & efficiency calculation. Rotor resistance starter, etc. • Speed control of Induction motors by various methods. • Practical application of A.C. motors. • Connect, start and run a 3 phase synchronous motor. • Connection of single phase motor, identification, testing, running and reversing. • Maintain service and troubleshoot the single phase motor. • Install a single phase motor. Overhauling of AC motors. • Calculate and use of shunt resistors.	Poly phase induction motor. Working principle, with special reference to magnetic field slip. Construction of square cage and slip ring Induction motor, their characteristics and their starting and controlling gear. Double square cage Induction motor – Introduction, working principle and advantages. Synchronous motor – Introduction and working principle. No load, load and over load condition, single phase and poly phase synchronous motor, characteristic of synchronous motor, effect of variation of excitation on power factor. Auto synchronous motor, its starting controlling and protective devices. Auto synchronous moor with special salient polo type X sq. cage motor. Their industrial application. Study of single phase induction motors. More emphasis for electronic circuits, drawing, symbols, instruments and their use etc. Study of Single phase A.C. series motor in detail. Repulsion start induction and repulsion induction.
6-8	• Use of Motor generator set • Maintenance, troubleshooting & servicing of DC motors. Overhaul a DC motor. • Test and shunt the various types of Resistors. • Maintenance, troubleshooting & servicing of Incandescent lamp, carbon lamps metal filament vacuum lamp, gas filled lamp and special type lamps	Convertors: M.G. set. Its description and disadvantages. Rotary convertor – construction. Number of tappings in wave and lap winding, voltage and current ratio, convertor rating as to number of phases and affect of P.F. its uses. Mercury Arc rectifier introduction working, its essential parts. Rating, capacity and faults. Method of connecting it to a transformer. Hot cathode rectifier, Tungar rectifier, Metal or solid contact rectifier and mercury arc rectifier. Their

		construction, working principle and use. Electrolytic rectifier. Electric lamp and lighting illumination, factors for considering, illumination design, characteristic and advantages of good illumination, advantage of correct illumination, spacing of outlets, spacing from walls, mounting height and levels of illumination. Incandescent lamp, carbon lamps metal filament vacuum lamp, gas filled lamp and special type lamps – their constructions, expected life and efficiency in lumers per watt. Colour and wattage available and holding arrangement. Luminiscent Lamp: Mercury vapour lamp, sodium lamp and fluorescent tube, their construction, construction, characteristic, wattage, available connection, normal life in burning hours etc.
9	• Identify & select different type of Instruments. • Use of **-P**MMC , MI meter, Multi-meter(Digital/Analog) , Wattmeter, P F meter, Energy meter, Frequency meter, • Phase sequence meter, Digital Instruments, etc • Range extension of meters.	Electrical instruments – classification as regards standards, forces employed choice of instrument classification as regards suitability for current. Moving coil – Ammeter and voltmeter. Moving iron, Ammeter and voltmeter, K.W. meter and Frequency meter. Connection of P.F. meter and working. Thermo couple and its uses. KVAR and maximum demand indicators including all types of electronic instruments. Electrical instrument. Ferrenti type DC energy meter i.e. ampere hour meter. Ac energy meter – single phase, 3 phase 3 wire and 3 phase 4 wire. DC wiring calculation for a certain load, distances and percentage drop. AC wiring calculation, factors involved. General formula, important and useful three phase formula for calculating KW, KVA, line amps, HP etc.
10	• Identify AC armature winding terms	AC Armature winding terms. Different

	• Identify coil pitch, front pitch, pole pitch, back and winding pitch. • Test the winding factors • Use insulating materials for armature windings	shapes of the coil – their advantages and uses, simple calculation to determine number of coils per group in equal and unequal – coiled groups. Insulating materials, used in armature winding their classification. Armature and startor slots. Common faults in AC winding and test for locating them. Use of grolers reconnecting and exciting winding for a change in voltage or speed, including latest testing methods applied in industry. The procedure in rewinding a machine for the same condition.
11	• Diagnose faults in poly phase stator winding • Identify and apply the working of diode and triode • Test the underground cables for open, short circuit & ground fault and also check insulation resistance. • Schematic diagram of a different type of Circuit Breakers. • Replacement of fuse element. • Installation of fuses on H.T. Line & L.T. Line. • Test and troubleshoot various DC windings.	Most commonly occurring faults in a poly phase stator winding and the test for locating these faults. Reconnecting and existing winding for different conductors (latest testing methods applied in industry). DC winding – Introduction, winding terms- simplex, multiplex and multiple winding. Testing for faults in DC armature winding. Simple estimation of material etc. Comparison of simplex and multiplex winding both in lap and wave winding for the same power output. Electron theory: Introduction, working principle of diode, triode and their application to the industry. Importance of industrial electronics in industry, photo cell and amplifier. Construction of underground cables. Material used in cable joints. Use of Apoxy compound for installations. Brief description of air circuit breaker and oil circuit breaker and their arc controlling devices. Hydro electric scheme – Introduction and brief description of Hydro electric plant.

12	• Install electrical • Practice on Earthing- different methods of earthing. • Measurement of Earth resistance by earth tester. • Testing of Earth Leakage by ELCB and relay. • Practice on three phase four wire system for understanding phase and line voltage & current.	Electrical installation – Introduction to mechanical protection, general layout heating. Small power and large power installation, illumination scheme and domestic appliances. Erection of equipment, Installation of machines, types of foundation bolts. Method of starter lining up pulleys. Position of terminal box and use of side rails. Three phase motor, its working and use. Filling of machine history sheet and maintenance card. Study wiring circuit details. Give more stress to know electronics circuit apparatus and their connections. Modern substations. Tap changing of transformers.
13	**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.*

In the third year the apprentice will be required to obtain gas testing certificate under the Mines Act, and First Aid Certificate from the St. John Ambulance Association, whenever applicable, before appearing in the final trade test of the Apprenticeship Act.

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block – I		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	Electricity and its uses. Electric current positive and negative terminals. Use of switches and fuses. Conductors and insulators.	**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
2.	Applied workshop problems involving common fractions & decimal, multiplication and division application of fractions to shop problems.	**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
3.	Properties and uses of copper, zinc, lead, tin aluminium, brass, bronze, solder, bearing metals, timber and rubber.	**Drawing of Geometrical Figures**: Definition, nomenclature and practice of - - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements
4.	Properties and use of cast iron, wrought iron, plain carbon steel, high speed steel and alloy steel.	**Lettering and Numbering** as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.
5.	Decimals – additions, subtraction, multiplication. Conversion of decimals to corda fractions shop problems.	**Free Hand sketch:** Hand tools and measuring instruments used Electrician trade

6.	Brief description of manufacturing process of pig iron and cast iron and steel.	**Free hand drawing of :** - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension - Transferring measurement from the given object to the free hand sketches.
7.	Reduction of common fractions to decimals fraction- shop problems.	

Block – II		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	Brief description of manufacturing process of copper and aluminium	**Symbolic Representation** (as per BIS SP:46-2003) of : - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings
2.	Metric & S.I system- Metric weights and measurements units- conversion factors. E.g. L.H.T. force, Energy, Power.	**Construction of Scales and diagonal scale**
3.	Meaning of tenacity, elasticity, malleability, brittleness, hardness, compressibility and ductility- examples.	**Three phase Induction motor :** Free hand sketching of Slip-ring and Squirrel cage Induction motor. Typical wiring diagram for drum controller operation of A.C. wound rotor motor.
4.	Shop problems using metric and S.I. system of weight and measurement.	Drawing the schematic diagram of Autotransformer starter, DOL starter and Star Delta Starter. Drawing the schematic diagram of A.C. motor speed control by SCR /AC Drive.
5.	Effects of alloying elements on properties of cast iron and steel.	**Distribution of Power** Types of insulator used in over head line. (Half sectional views) Different type of distribution systems and methods of connections. Layout diagram of a substation. Single line diagram of substation feeders. Key diagram of a power station, central controlling panel.
6.	Square root the square root of a perfect square, the square root of a whole number and a decimal. Trigonometry and mensuration calculation.	
7.	Mass- unit of mass, force, absolute unit of force. The weight of a body unit of weight shop problems.	
8.	Percentage and its application to shop problem.	

9.2 EMPLOYABILITY SKILLS

(DURATION: - 110 HRS.)

Block – I (Duration – 55 hrs.)	
1. English Literacy 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 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. 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 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.
3. Communication Skills Duration : 15 Hrs. Marks : 07	
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.
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.
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.
Facing Interviews	Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview.
Behavioral Skills	Problem Solving Confidence Building Attitude
Block – II **Duration – 55 hrs.**	
4. Entrepreneurship Skills Duration : 15 Hrs. Marks : 06	
Concept of	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue

Entrepreneurship	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 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** 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.
Accident & safety	Basic principles for protective equipment. 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. 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 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 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 ELECTRICIAN (MINES) TRADE:

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. Use of Electricians basic hand tools.
2. Make joints using single strand cables.
3. Make joints using multi strand cables.
4. Use of Switches, plugs, sockets, etc.
5. Use of cut-out, fuses, regulators, test lamps, etc.
6. Make electrical circuits on wooden boards.
7. Use of electrical meters including electronics and digital instruments.
8. Install and test of light and power, circuits in casting and capping, TRS & PCV cables.
9. Use of megger, earth resistance meter, condenser wire gauge, tachometer etc.
10. Locate and rectify faults in simple circuits.
11. Knowledge of working at height.
12. Operate and maintain AC/ DC motors and starters.
13. Know about Cable jointing, soldering, insulating etc.
14. Identify the electrical equipment requirements as per the specifications in the work instructions for installation of electrical substations/ electrical equipment/ electrical wiring or fixtures.
15. Winding of low and medium voltage armatures, field coils and starters.
16. Knowledge of distribution of fuse boxes and use of growlers and soft insulation.
17. Knowledge of gas discharge and GLS lamps.
18. Knowledge of intermediate and drum switches.

B. Block – II

19. Electrical installation and erection of machines.
20. Running, Care and maintenance :

b. Ac motors and starters given types Applied to the present industrial equipment electronic hydraulic, pneumatic controls fitted with the various machines, etc. and electronics

b. DC motors and starters- Given types

21. Make a buzzer/ electric bell/ transformer.
22. Rewinding of small power transformer.

23. Test and rectify faults in M-G. Set rotary converter and rectifier.
24. Knowledge of testing and repair of alternators, generators, electrical machines and electronic controls.
25. Testing of mine gases- Use of instruments and apparatus for detection of mine gases. Construct and assemble flame safety lamp, detection of mine gases construction and fire-damp by flame safety lamp.
26. Industrial switch board work.
27. Wiring in mines.
28. Lay shaft cables.
29. Install mine lights and switches and maintenance of cap lamps and chargers.
30. Study of different types of mining cables.
31. Cable lying with joints and termination including filling of compounds, supporting cables in mines. Care and maintenance of cables.
32. Locate and rectify faults in electrical equipment e.g. drill transformers, gate box, starters, mines locatives etc. with special attention to safety signals.
33. Install and maintain electrical equipment in long wall mining.
34. Maintain electrical motors with special reference to flame proof enclosure.
35. Maintain circuit breakers and protective gears.
36. Use and maintain intrinsically safe apparatus.
37. Install and maintain bell circuit, telephone circuit, signalling circuit including shaft signals and electronic circuits.
38. Familiarise with the working of surface and underground substations.

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

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

ELECTRICIAN (MINES)			
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**	**Specification**	**Quantity**
1.	Steel tape,	3 mt length	21 nos.
2.	Plier insulated	150mm	21 nos.
3.	Plier side cutting	150mm	21 nos.
4.	Nose plier	150mm	21 nos.
5.	Screw driver	150 mm	21 nos.
6.	Electrician connector screwdriver, insulated handle thin stem	100mm	21 nos.
7.	Heavy duty screwdriver	200mm	21 nos.
8.	Electrician Screwdriver, thin stem, insulated handle	250mm	21 nos.
9.	Punch centre	150mmX9mm	21 nos.
10.	Electrician knife	50 mm blade	21 nos.
11.	Neon tester		21 nos.
12.	Steel rule	300mm	21 nos.
13.	Hammer, Cross peen with handle	250 gm	21 nos.
14.	Hammer, ball peen with handle	750gm	21 nos.
15.	Gimlet	6mm	21 nos.
16.	Bradawl	150mm x 6mm	21 nos.
17.	Pincer	150 mm	21 nos.
18.	Scriber	knurled centre position	21 nos.
B : INSTRUMENTS & GENERAL SHOP OUTFIT			
19.	C- clamp, 100mm,	150mm, 200mm	2 Nos. each
20.	Adjustable spanner,	150mm, 300mm	2 Nos. each
21.	Blow lamp,	0.5 ltr	1
22.	Melting pot		1
23.	Ladder		1
24.	Chisel cold firmer,	25mm x 200 mm	2
25.	Chisel	25mm & 6 mm	2 Nos. each
26.	Hand drill machine		2
27.	Portable electric drill machine,	12 mm capacity	1
28.	Pillar Electric Drill machine,	12 mm capacity	1

29.	Allen key set		2 sets
30.	Oil can	0.12 ltr	1
31.	Grease gun		1
32.	Out side Micrometer		2
33.	Motorised Bench grinder		1
34.	Rawl plug tool & bit		2 sets
35.	Pulley puller		2
36.	Bearing puller		2
37.	Pipe vice		2
38.	Thermo meter	0-100 deg C	1
39.	Scissors blade 150mm		2
40.	Crimping tool		2 sets
41.	Wire stripper	20 Cm	2
42.	Chissel cold flat	12mm	2
43.	Mallet hard wood	0.5Kg	2
44.	Mallet hard wood	1 Kg	2
45.	Hammer extractor type,	0.4 Kg	2
46.	Hacksaw frame,	200mm & 300mm adjustable	2 each
47.	Try square,	150 mm blade	2
48.	Outside & inside divider caliper		2 each
49.	Pliers flat nose	150mm	4
50.	Pliers round nose,	100 mm	4
51.	Tweezers,	100mm	4
52.	Snip straight & bent	150mm	2 each
53.	Double ended spanner set metric		2 sets
54.	HSS drill bit set	2-12mm	4 sets
55.	Plane, smoothing cutters	50mm	2
56.	Gauge, wire imperial		2
57.	File, flat	200mm 2nd cut	8
58.	File half round	200 mm 2nd cut	4
59.	File round	200mm 2nd cut	4
60.	File flat	150mm rough	4
61.	File flat	250mm bastard	4
62.	File flat	250mm smooth	4
63.	File Rasp half round	200 mm bastard	4
64.	Soldering iron,	25 W, 65 W	2 each
65.	Copper bit soldering iron	0.25 kg	2
66.	Desoldering gun		4
67.	Hand vice	50mm jaw	4
68.	Bench vice	100mm jaw	6
69.	Pipe cutter to cut pipes upto	5cm dia	2
70.	Stock & die set	for 20mm to 50 mm GI	1

		pipe	
71.	Stock & dies conduit		1
72.	Ohm meter; series & shunt type		2 each
73.	Multimeter (analog),	0-1000 M ohm, 2.5 to 500V	2
74.	Digital Multimeter		4
75.	AC voltmeter	MI 0-500V	2
76.	Milli Voltmeter centre zero	100-0-100 mV	1
77.	DC milli Ammeter	0-500 mA	1
78.	Ammeter MC	0-5A, 0-25A	1 each
79.	AC Ammeter MI	0-5A, 0-25A	1 each
80.	Kilo Watt meter	0-1-3 KW	1
81.	AC Energy meter, single phase	5A, 3 ph 15 A	1 each
82.	Power factor meter, single phase		1
83.	Frequency meter		1
84.	Flux meter		1
85.	DC power supply	0-30V, 2 Amp	2
86.	Rheostats	0-1 ohm 5A, 0-10 ohm 5A, 0-25 ohm 1A, 0-300 ohm 1A	1 each
87.	Digital Tachometer		1
88.	Growler		1
89.	Tong tester / clamp meter	0-100 A AC	1
90.	Meggar	500V	1
91.	Oscilloscope dual trace,	30 MHz	1
92.	Function Generator		1
93.	Hygrometer		1
94.	Lux meter		1
95.	Hydro meter		1
96.	Current transformer	415 V, 50 Hz , CT Ratio 10/5A,	1
97.	Potential Transformer,	415/110 V	1
98.	Wood Saw,	250 mm	1
99.	Tenon Saw		1
100.	Guarded Test Lamp		1
C : GENERAL MACHINERY INSTALLATIONS			
101.	Voltage Stabilizer,	input 15-230 V AC, Output 220 V AC	1
102.	3 point DC starter		1
103.	4 point DC starter		1
104.	Electrical Machine Trainer: suitable for demonstrating the construction & functioning of different types of DC machines & AC machines (single phase & 3		1

	phase). Should be fitted with brake arrangement, Dynamometer, Instrument panel & power supply unit		
105.	Motor generator (AC to DC): consisting of Squirrel cage induction motor with star delta starter & directly coupled to DC shunt generator & switch board mounted with regulator, air breaker, ammeter, voltmeter, knife blade switches & fuses, set complete with case iron & plate, fixing bolts, foundation bolts & flexible coupling.	Induction motor rating: 5 KW, 400V, 50 Hz, 3 ph. DC shunt generator rating: 3.5 KW, 220V	1 set
106.	Used DC generators – series, shunt & compound type, (for overhauling practice)		1 each
107.	DC shunt motor	2 – 2.5 KW, 220V	1
108.	DC series motor coupled with mechanical load,	2 KW, 220V	1
109.	DC compound motor with starter & switch,	2.5 KW, 220V	1
110.	Single phase Transformer, core type, air cooled,	1 KVA, 240/415 V, 50Hz	3
111.	3 phase transformer, shell type, oil cooled with all mounting,	3 KVA, 415/240V, 50 Hz (Delta /Star)	2
112.	Starters for 2 to 5 HP AC motors. a. Resistance type starter. b. Direct on line starter. c. Star delta starter – Manual, semi-automatic & Automatic. d. Auto Transformer type starter		1 each
113.	Motor generator (DC to AC) set consisting of Shunt motor with starting compensator & switch directly coupled to AC generator with exciter & switch board mounted with regulator, breaker, ammeter, voltmeter, frequency meter, knife blade switch & fuses etc. Set complete with cast iron bed plate, fixing bolts, foundation bolts & flexible coupling.	Shunt motor Rating-5KW, 220V. AC generator rating – 3 ph, 4 wire, 3.5 KVA, 400/230 V, 0.8 pf, 50 Hz	1 set
114.	AC squirrel cage induction motor with star delta starter & triple pole Iron clad switch fuse.	2 to 3 HP, 3 ph, 400V, 50 Hz	1
115.	AC 3 ph wound slipring motor with starter & switch,	5 HP, 400V, 50 Hz	1
116.	Single phase capacitor motor with starter switch,	1 HP, 230 V, 50 Hz	1
117.	Universal motor with starter / switch,	230 V, ¼ HP, 50 Hz	1
118.	Stepper Motor with digital controller,		1

119.	Shaded pole motor,		1
120.	3 ph Synchronous motor, with accessories	3 HP, 415 V, 50 Hz, 4 pole,	1
121.	**Domestic Appliacnes:** Electric hot plate,	1500W	1
122.	Electric kettle	1500W	1
123.	Electric Iron,	1500 W	1
124.	Immersion heater,	1500 W	1
125.	Ceiling fan		1
126.	Geyser storage type,	15 lts min	1
127.	Mixer & Grinder		1
128.	Washing Machine		1
129.	Inverter,	1 KVA with 12 V battery, input 12 V DC, Output 220V AC	1
130.	Thyristor /IGBT controlled DC motor Drive, with tachogenerator feed back arrangement,	1 HP	1 set
131.	Thyristor / IGBT controlled AC motor Drive with VVVF control,	3 ph, 2 HP	1 set
132.	Battery charger		1
133.	1 Ph variable Auto Transformer		1
134.	Load bank, lamp / heater type	5 KW	1
135.	Brake test arrangement with 2 spring balance,	0 to 25 Kg rating	1
136.	Discreet component trainer		2
137.	Oil testing kit		1
138.	Digital multimeter		21 nos.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: ELECTRICIAN (MINES)

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		20+1 set
2.	Set square celluloid 45^o	(250 X 1.5 mm)	20+1 set
3.	Set square celluloid 30^o-60^o	(250 X 1.5 mm)	20+1 set
4.	Mini drafter		20+1 set
5.	Drawing board IS: 1444	(700mm x500 mm)	20+1 set
B : Furniture Required			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1	Drawing Board		20
2	Models : Solid & cut section		as required
3	Drawing Table for trainees		as required
4	Stool for trainees		as required
5	Cupboard (big)		01
6	White Board	(size: 8ft. x 4ft.)	01
7	Trainer's Table		01
8	Trainer's Chair		01

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.		

ANNEXURE-II

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	**Maximum Marks (Total 100 Marks)**		**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**	**Total internal assessment Marks**	**Result (Y/N)**
	Candidate Name	**Father's/Mother's Name**	Safety consciousness	Workplace hygiene	Attendance/ Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to handle tools & equipment	Economical use of materials	Speed in doing work	Quality in workmanship	VIVA		
1														
2														