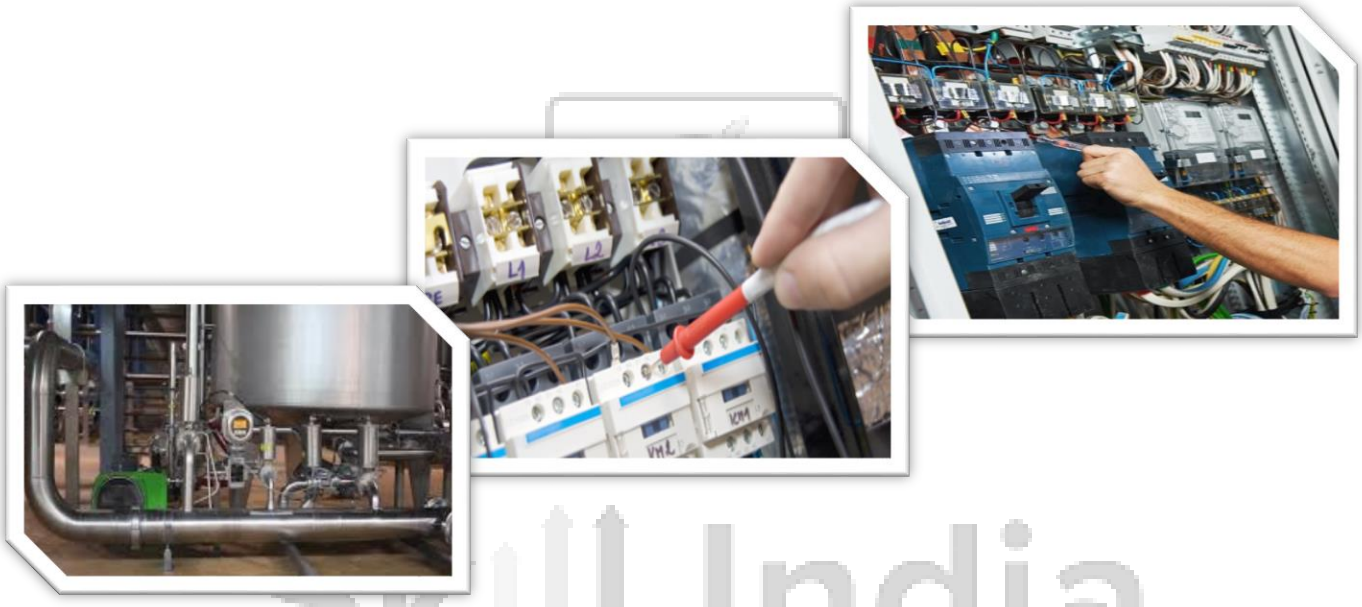
ELECTRICIAN (STEEL PLANT)

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5



SECTOR – PRODUCTION AND MANUFACTURING

सत्यमेव जयते

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

Directorate General of Training

Skill India
कौशल भारत-कुशल भारत

ELECTRICIAN (STEEL PLANT)

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
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1. TATA STEEL, Jamshedpur

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 (Steel Plant) trade under ATS is delivered through industries. 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.
- Observe safety in Electrical Works. Provide First Aid for Electrical accidents.
- Operate and maintain Electrical Power Distribution System of an installation.
- Provide Electrical connections and power supply to all appliances, machines etc.
- Trouble shoot, repair and maintain all electrical fittings, accessories and appliances.
- Trouble shoot, repair and maintain equipments of a Electrical substation
- Install earth stations, measure & improve earth resistance, & maintain.
- Trouble shoot & repair the problems in Rectifiers, power supplies, stabilisers, thyristor circuits, etc.
- PLC programming
- measurement of various process parameters related to steel plant. Process control system and PID controllers.
- Working with hydraulic & Pneumatic components and circuits. Proportional and servo hydraulics

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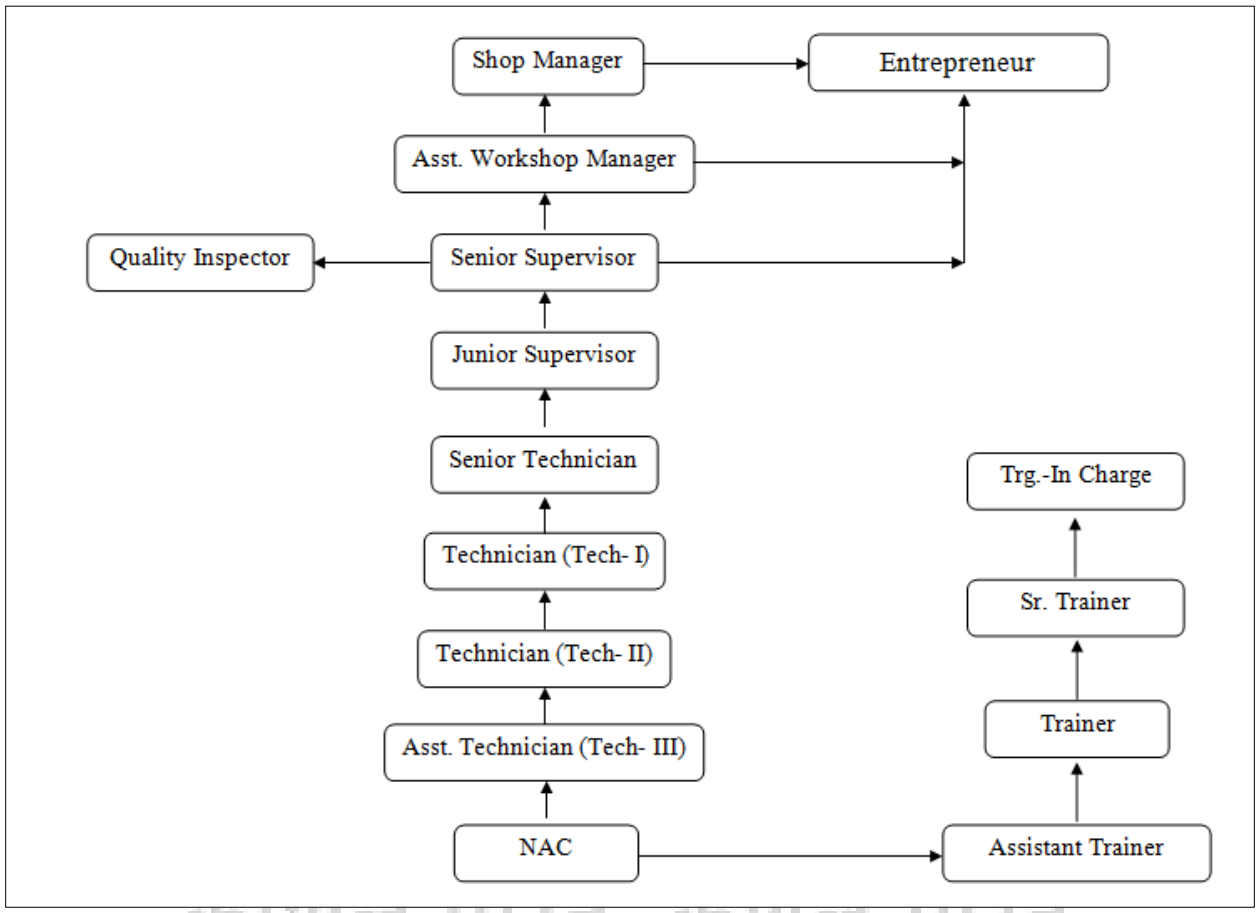
- Testing and study of IGBT, power plate. Demo of a real time microprocessor based AC drive used in different processes in industries.

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**

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A. Basic Training

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

Sl. 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. Engg. Course :- (**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. Engg. course :-(**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 Engg. yrs. course	1000 hrs.	3120 hrs.	4120 hrs.
For 01 yr. Engg. course	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

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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, General

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.

Maintenance Assistant/Helper

Maintenance Assistant/Helper is responsible for providing assistance to the maintenance personnel in repairing of the breakdown equipment by fetching the tools, spares and providing material handling support.

Reference NCO-2015:
(i) 7411.0100 - Electrician General
(ii) 7412.0801 - Maintenance Assistant/Helper

4. NSQF LEVEL COMPLIANCE

NSQF level for Electrician (Steel Plant) 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 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 (STEEL PLANT)
NCO-2004	7411.0100 7412.0801
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	Passed 10th Class with Science and Mathematics 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. 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 (Steel Plant) Apprenticeship	1. 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 Machinist (Grinder) 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 precautions to be followed in the section/plant including need of special protective equipment. Practice providing First Aid.
2. Prepare different types of documentation as per industrial need by different methods of recording information
3. Identify & use all hand tools
4. Check the gauges of wire & select suitable wires for the required current rating. Practice wire joints & providing cable glands. Soldering practice
5. Carryout fitting & carpentry jobs

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6. Connect & measure voltage, current, resistance power & energy in DC & AC(1ph & 3ph) circuits. Use of power analyzer, measurement of THd, Harmonics due to digital switching.
7. Electrical wiring: Repair / replace switches, sockets, light points. Provide new points in PVC casing capping & PVC conduits
8. Charging & maintenance of different type of Batteries. Checking specific gravity, voltage, condition monitoring of Battery Bank, assessment of high spots, on line isolation precautions etc.
9. Install pipe & plate earth stations. Measure earth resistance, improve the same & maintain earth stations. Earth Monitoring systems with reference to various standards, familiarization with health monitoring equipment
10. Providing power supply to motors, equipments& appliances. Crimping the lugs, providing cable glands & connections
11. Attending to minor faults in machines, their controls & appliances
12. Replacing the bulbs, tubes, trouble shooting, repair & maintenance. Wire up in PVC casing & capping.
13. Assisting in operation & maintenance of Transformer substation, circuit breakers, batteries etc
14. Trouble shooting rectifiers, filters, power supplies, voltage stabilizers, controlled rectifiers. Identifying faulty thyristors in circuits, replacing them
15. Provide light/socket points, for various equipments and appliances
16. Decides the size of cable & provides power supply to machines &equipments, provide earth connections
17. Testing the condition of DC motor Checking power input & output in DC drives. Replacing faulty components

Block – II

18. Observe & practice safety precautions to be followed in the section/plant including need of special protective equipment. Practice providing First Aid.
19. Prepare different types of documentation as per industrial need by different methods of recording information
20. Connection & testing of single & three phase motor. Checking power input & output in AC drives. Replacing faulty components. Power factor correction using Synchronous motor
21. Checking Electrical connections, locating faults and removal of faults in Air Compressor, AC plants, cranes, lifts, hoists. Operates & maintain Air compressor, AC plant, cranes, lifts, hoists
22. Diesel Generating set: Operation, operating switch gears, trouble shooting & maintenance, Parallel operation of Generators to a infinite bus bar. Protective system for Generator. Care and maintenance of Alternator
23. Underground cable joining, Testing of underground cables, trouble shooting, Locating faults, open circuit, short circuit & leakage in cables, performing cable joints. Maintenance of lightening arrestor

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24. Operation of Control Room. Operation of Switchgear. Programming of PLC , Hardware of DCS. Communication with different field and control devices. Reading of panel meter & filling log sheet.
25. Working of LT and HT Switch- gears and protective relays. Maintenance of transformer equipment such as : Oil gauge, Tap Changer, Bushes, Breather, Earth fault relay, Protective relay, etc. Installation operation and maintenance of oil circuit breaker, Air circuit breaker, SF6 circuit breaker, Vaccum circuit breaker, etc
26. System and equipment used for the measurement of various process parameters related to steel plant. Process control system and PID controllers. Different control strategies used in steel plant
27. Principle of working of hydraulic & Pneumatic components and circuits. Proportional and servo hydraulics and its applications. Symbols of basic hydraulic and pneumatic components Interfacing of fluid power devices with electrical controller
28. Different types of raw material used for iron making and their sources. Iron and steel making processes. Hot and cold rolling process.
29. QMS and its important provisions. Concept and application of TPM. Quality Control tools and systems practiced in industries
30. Loading, unloading and shifting of common and uncommon shapes of material with the help of different lifting tools and tackles. Working at height. Reaving pulley block in different part. Communicate with crane operator through signals
31. Knowledge of Quality assurance required in Electrical works. Energy saving concept.
32. Demo on Microprocessor programming. Identification of different parts of a personal computer. Demo on industrial weighing system
33. Observation of different types of power electronic components Drawing the V-I characteristic of a thyristor. Construct different firing circuits of thyristors (RC, UJT, Ramp and Cosine firing circuits) and record the parameter. Construct single phase and three phase converter -half wave, full wave, half controlled etc. Construct different types inverter circuit and check the waveforms. Checking of power MOSFET, thyristors, IGBT, GTO, IGCT etc
34. Testing and study of IGBT, power plate. Demo of a real time microprocessor based AC drive used in different processes in industries. Demonstration on parameterization of AC drives. Exercise on maintenance and trouble shooting of AC drive

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	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.

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]*	2.2 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 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.

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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)	
*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.*	

BASIC TRAINING (Block – I)
Duration: (03) Three Months

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

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

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	Routine care & maintenance of Batteries.	battery. Load & back up time calculation.
7.	**Practice on Earthing**- different methods of earthing. Measurement of Earth resistance by earth tester. Testing of Earth Leakage by ELCB and relay.	**Earthing**- Principle of different methods of earthing & selection. i.e. Pipe, Plate, etc Importance of Earthing. Improving of earth resistance Earth Leakage circuit breaker (ELCB).
8.	**Diodes**-symbol - Tests - Construct & Test Half wave rectifier ckt., Full wave rectifier ckt., Bridge rectifier ckt. Measurement & calculation of electrical parameters using C.R.O. Different wave shapes of rectifiers and their values using C.R.O. Identification of terminals, construction & Testing of transistor. Operation, maintenance & troubleshooting of inverter, Voltage stabilizer, DC regulated power supply, UPS, etc.	**Basic electronics**- Semiconductor energy level, atomic structure 'P' type and 'N' type. Type of materials –P-N-junction. Classification of Diodes – Reverse and Forward Bias, Heat sink. Specification of Diode PIV rating. Explanation and importance of D.C. rectifier circuit. Half wave, Full wave and Bridge circuit. Filter circuits-passive filter. Working principle and uses of an oscilloscope. Types of transistors & its application. Specification and rating of transistors.
9.	Practice in casing, Capping and Conduit wiring. Testing of wiring installation by meggar. Fixing of calling bells/buzzers. Identification & demonstration on conduits and accessories & their uses, cutting, threading & laying. Installation, Testing, Maintenance and Repairing of wiring. Application of fuses, relay, MCB, ELCB.	**Electric wirings**, I.E. rules. Types & selection of wirings both domestic and industrial. Specifications for wiring. Grading of cables and current ratings. Principle of laying out in domestic wiring. Estimate the cost of wiring system Voltage drop concept. **Wiring system -** P.V.C., concealed system. Specifications, standards for conduits and accessories - Power Wiring - Control Wiring - Information Communication - Entertainment Wiring. Testing of wiring installation by meggar Study of Fuses, Relays, Miniature circuit breakers (MCB), ELCB, etc.
10-11.	Prepare simple electromagnet and find the polarity. Identification of the parts of a D.C.	**Magnetism**- classification of magnets, methods of magnetizing, magnetic material. **Electromagnetism-** Solenoid, field around

	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.	conductors carrying current, polarity, screw-rule, right- hand grip rule, advantages and application of electromagnet. **D.C. Machines -** General concept of Electrical Machines. **Principle of D.C. generator.** Use of Armature, Field Coil, Polarity, Yoke, Cooling Fan, Commutator, slip ring Brushes, Laminated core. Explanation of **D.C. Generators**-types, parts-Practical uses. Description of series, shunt and compound generators and their selection. Types of D. C. Motor. Starters used in D.C. motors Types of speed control of DC motors in industry. Application of D.C. motors. Care, Routine & preventive maintenance.

12.	Identification of types of transformers. Connection of transformers, Transformation ratio, testing of transformer, calculate the losses & efficiency. Use of Current Transformer (C.T.) and Potential (Voltage) transformer (P.T.) Testing of single phase and Three Phase Transformers – Cleaning, maintenance, testing and changing of oil. Identify & select different type of Instruments. Use of -PMMC , MI meter, Multi-meter(Digital/Analog) , Wattmeter, P F meter, Energy meter, Frequency meter, Phase sequence meter, Digital Instruments, etc. Range extension of meters.	Working principle of **Transformer,** losses & efficiency. classification C.T., P.T. Instrument and Auto Transformer(Variac), Construction, Single phase and Poly phase. Type of Cooling for transformer. Protective devices. Components, Auxiliary parts i.e. breather, Conservator, buchholz relay, other protective devices. Transformer oil testing and Tap changer (off load and on load). Dry type transformer. Bushings and termination. **Electrical Measuring Instruments -** -types, indicating types PMMC & MI meter (Ammeter, Voltmeter) -Range extension -Multimeter(Digital/Analog) -Wattmeter - P.F. meter - Energy meter (Digital/analog) –Insulation Tester (Megger), Earth tester. -Frequency meter -Phase Sequence meter -Multimeter –Analog and Digital -Tong tester -Techometer.
13	**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.*

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BASIC TRAINING (Block – II)
Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1-2	Identification of parts and terminals of AC motors. Connection, starting, running of AC motors using Starters. Load test & efficiency calculation. Rotor resistance starter, etc Speed control of Induction motors by various methods. Practical application of A.C. motors. Connection of single phase motor, identification, testing, running and reversing. Maintain service and trouble shoots the single phase motor. Install a single phase motor. Overhauling of AC motors.	**Three phase Induction motor** – Working principle –Production of rotating magnetic field, Squirrel Cage Induction motor, Slip-ring induction motor. Control & Power circuit of starters D.O.L Starter, Forward /Reverse starter, Star /Delta starter, Autotransformer starter, Rotor resistance starter, etc Single phasing preventer. Application of Induction Motor Care, Routine & preventive maintenance. **Single phase induction motor-** Working principle, different method of starting and running (capacitor start, permanent capacitor, capacitor start & run, shaded pole technique). FHP motors, Repulsion motor, stepper motor, Application of single phase motor.
3	Connect, start and run a 3 phase synchronous motor. Practice for Power factor correction.	**SYNCHRONOUS MOTOR -** Working principle, effect of change of excitation and load. Power factor correction of industrial load.
4	Identification of parts and terminals of Alternator. Connection, starting, running of Alternator. Practice on alternators, voltage Building, Parallel operation & load sharing. Practice on installation, running and maintenance of Alternators.	**Alternator** Explanation of alternator, working principle, voltage build-up, loading, Regulation. Types of prime mover, phase sequence, Parallel operation & load sharing. Specification of alternators.
5-6	Measurement of pit resistance. Demonstration of HV safety devices Use of HV tester, cool coat, discharge rod. Layout of various types of power transmission equipment/ devices – conductors, support, insulators and cables.	**Power Generation, Transmission and distribution System** Introductory concepts - generating stations: Hydel, Thermal, Nuclear, Gas turbine, IC engine etc. High voltage safety, use of safety devices like HV tester, discharge rod, cool coat. Transmission O/H line, conductor, support,

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	Cable jointing practices. Single line diagram of interconnected industrial power supply system. Polarity marking of CT Connection. Connection of lightening arrestors.	insulators, their merit and demerit, sag, span, joints, guard, binding of insulators, stay, damper jumpers, erection of line, maintenance and inspection of transmission lines. Cables- construction, classification of cables, property of XLPE, paper, PVC, insulation, jointing and laying of cable, testing and fault localization. Indoor and outdoor substation, layout, single line diagram, CT& PT, isolators, earth switch, transformer, lightening arrestor, reactor, breaker, bus and its protection. Energy management, maximum demand, load factor, connected load, diversity load curve, tariff. LDC- monitoring system for power generation and utilization. Indian electricity rules pertaining to safety of supply system, LT and HT equipment, O/H transmission.
7	Connection of relays, Maintenance and adjustment of arc chute and contact. Opening and assembling - pole assembly, trip assembly and hand assembly. Maintenance of different type of Circuit Breakers. Demo on parameterization of digital relay and numerical relay.	**Power system protection** Switch gear- arcing phenomena, ACB parts and their function, maintenance of arc chute, contacts, limitation and tightening, testing and calibration of releases, trouble shooting. Construction, working and maintenance of OCB, VCB and SF6, GIS, their merit and demerit. Protection relay: classification, terms and definitions, comparison of mechanical, solid state, digital and numerical relays. O/C relay- its testing and calibration, E/F relay – its testing and calibration. Different types of E/F relays, reverse power relay, differential relay, restricted E/F relay, feeder protection relay, directional earth fault relays. Digital motor protection relay, numerical relays used with power system.
8	Operation of a controller, setting of its PID values, controller tuning. Testing of a control valve, I/P converter and valve positioners.	**Process Control System** Introduction, process variables, manual and automatic, close loop and open loop process control systems, process disturbances.

		Controller – types, P, D & I control actions. Tuning of a controller. **Final control elements**: types, working principle, construction, calibration and maintenance of I/P converters, Control valves & actuators, Valve positioned, power cylinders. **Reading and interpretation of PI diagrams**, instrument manuals and part list, panel wiring diagram etc.
9	Familiarization with different I/O modules of PLC. Development of simple programmes involving bit level instructions, timers and counters, simple data manipulation instructions. Feeding and running the programmes in PLC, I/O forcing. Documentation and editing of programmes. Simple fault finding and trouble shooting. Demonstration of different communication system used in networking of PLC. **DCS** Familiarization with hardware of DCS, Process operation using DCS.	**Programmable Logic Controller (PLC)**- Need and working principle, hard ware details. Function and connections of different cards. **Program techniques** of PLC, inputs, outputs, timer and counter instructions, data manipulation. **Development of simple programs** Documentation, different functional blocks & mathematical instructions. **Communication system** used in networking of PLC. **Data Acquisition System (DAS) & Supervisory Control And Data Acquisition (SCADA) System**- Basic structure, software and applications, introduction to HMI packages. **Distributed Control System (DCS)-** basic concepts, architecture advantages. **Level of automation** in steel industry.
10	Identify components such as reservoir, filter, pumps, float switch, valves, actuators etc. Operation of proportional and servo valves, functions of control and feedback components. Demonstration of simple hydraulic devices and circuits. Demonstration of simple pneumatic devices and circuits. Hydraulic and pneumatic circuits, reading and interpretation. Development of simple logic circuits in PLC and its testing.	**Industrial hydraulics and pneumatics** Basic principles of hydraulic and pneumatic, characteristic of fluid media, safety aspects. Operational details of fluid power control element. Energy converter, Fluid conditioner, Control valves. Symbols of basic hydraulic and pneumatic components. Basics of proportional and servo valves, its electrical and electronic circuitry, control and feedback systems.

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		Concepts of interfacing of hydraulic and pneumatic components with PLC.
11	Guided visit of different plants of the organization and familiarization with the process.	Different types of raw material used for iron making and their sources. Details of Blast furnace reactions, Cooling system, Cast House practices. Gas cleaning system. Hot metal Desulphurization. Complete Heat cycle in LD vessel. Secondary Steel Making. Casting of Steel. Theory of Rolling. Rolling of long products & flat products in hot and cold rolling.
12	Familiarization with Quality Management System, TPM, Small Group Activity (SGA) and Quality Circles as being practice in the industry. Practice of different type of knots & hitches used in material handling Reaving sets of pulley block. Splicing of manila rope. Inspection of wire rope. Use of mechanical & hydraulic jack, rope puller, chain puller, chain block, winch Inspection of tools and tackles Loading, unloading and shifting of common and uncommon shapes of material. Hand signal used in rigging.	Introduction to TQM, Quality management standards, its importance and important provisions. TPM- Concept, different pillars, its implementation in an organization. Problem solving technique used in industry - QC and SPC tools. Knowledge of different tools & tackles used in rigging. Construction and capacity of wire rope. Capacity of ropes (other than wire rope). Application of knots and hitches. Care and maintenance of wire rope. Different type of jacks, chain block and pull lift. Knowledge of different types of scaffolding. Material movement by using different rigging tools and techniques. Safety appliances & precautions in rigging. Maintenance of tools and tackles.
13	**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.*

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** - 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.	**Fractions & Simplification**: Fractions, Decimal fraction, Addition, Subtraction, Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple Simplification using BODMAS	**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.	**Square Root** : Square and Square Root, method of finding out square roots, Simple problem using calculator	**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.	**Ratio &Proportion:** Simple calculation on related problems. .	**Lettering and Numbering** as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case. -

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5.	**Percentage:** Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	**Free Hand sketch:** Hand tools and measuring instruments used Electrician trade
6.	**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.	**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.

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	**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.	**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	**Construction of Scales and diagonal scale** **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.
3.	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	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.

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4.	**Mensuration :** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle. Volume of solids – cube, cuboid, cylinder and Sphere. Surface area of solids – cube, cuboid, cylinder and Sphere.	**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

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.	

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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

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Block – II **Duration – 55 hrs.**	
4. Entrepreneurship Skills	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	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.

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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 (STEEL PLANT) TRADE:

1. Safety and best practices /Basic Industrial Culture (5S, KAIZEN, etc.)
2. Record keeping and documentation
3. Replacing the bulbs, tubes, fans, sockets, plugs, trouble shooting, repair & maintenance. Wire up in PVC casing & capping
4. Domestic appliances: Connecting, testing, repairing & maintaining
5. Install pipe & plate earth stations Measure earth resistance, improve the same & maintain earth stations
6. Operates & maintain Air compressor, AC plant, cranes, lifts, hoists
7. Trouble shoot & repair machine tools Preventive &corrective maintenance of all machine tools
8. Operation & maintenance of Transformer substation, circuit breakers, batteries etc
9. Trouble shoot & repair the problems in Rectifiers, power supplies, stabilisers, thyristor circuits, etc.
10. PLC programming
11. Measurement of various process parameters related to steel plant. Process control system and PID controllers.
12. Working with hydraulic & Pneumatic components and circuits. Proportional and servo hydraulics
13. Testing and study of IGBT, power plate. Demo of a real time microprocessor based AC drive used in different processes in industries.

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 pre-cautions to be followed in the section/plant including need of special protective equipment. Practice providing First Aid.
2. Prepare different types of documentation as per industrial need by different methods of recording information
3. Identify & use all hand tools
4. Check the gauges of wire & select suitable wires for the required current rating. Practice wire joints & providing cable glands. Soldering practice
5. Carryout fitting & carpentry jobs
6. Connect & measure voltage, current, resistance power & energy in DC & AC(1ph & 3ph) circuits. Use of power analyzer, measurement of THd, Harmonics due to digital switching.

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7. Electrical wiring: Repair / replace switches, sockets, light points. Provide new points in PVC casing capping & PVC conduits
8. Charging & maintenance of different type of Batteries. Checking specific gravity, voltage, condition monitoring of Battery Bank, assessment of high spots, on line isolation precautions etc.
9. Install pipe & plate earth stations. Measure earth resistance, improve the same & maintain earth stations. Earth Monitoring systems with reference to various standards, familiarization with health monitoring equipment
10. Providing power supply to motors, equipments& appliances. Crimping the lugs, providing cable glands & connections
11. Attending to minor faults in machines, their controls & appliances
12. Replacing the bulbs, tubes, trouble shooting, repair & maintenance. Wire up in PVC casing & capping.
13. Assisting in operation & maintenance of Transformer substation, circuit breakers, batteries etc
14. Trouble shooting rectifiers, filters, power supplies, voltage stabilizers, controlled rectifiers. Identifying faulty thyristors in circuits, replacing them
15. Provide light/socket points, for various equipments and appliances
16. Decides the size of cable & provides power supply to machines &equipments, provide earth connections
17. Testing the condition of DC motor Checking power input & output in DC drives. Replacing faulty components

Block – II

18. Observe & practice safety pre-cautions to be followed in the section/plant including need of special protective equipment. Practice providing First Aid.
19. Prepare different types of documentation as per industrial need by different methods of recording information
20. Connection & testing of single & three phase motor. Checking power input & output in AC drives. Replacing faulty components. Power factor correction using Synchronous motor
21. Checking Electrical connections, locating faults and removal of faults in Air Compressor, AC plants, cranes, lifts, hoists. Operates & maintain Air compressor, AC plant, cranes, lifts, hoists
22. Diesel Generating set: Operation, operating switch gears, trouble shooting & maintenance, Parallel operation of Generators to a infinite bus bar. Protective system for Generator. Care and maintenance of Alternator
23. Underground cable joining, Testing of underground cables, trouble shooting, Locating faults, open circuit, short circuit & leakage in cables, performing cable joints. Maintenance of lightening arrestor
24. Operation of Control Room. Operation of Switchgear. Programming of PLC , Hardware of DCS. Communication with different field and control devices. Reading of panel meter & filling log sheet.

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25. Working of LT and HT Switch- gears and protective relays. Maintenance of transformer equipment such as : Oil gauge, Tap Changer, Bushes, Breather, Earth fault relay, Protective relay, etc. Installation operation and maintenance of oil circuit breaker, Air circuit breaker, SF6 circuit breaker, Vaccum circuit breaker, etc
26. System and equipment used for the measurement of various process parameters related to steel plant. Process control system and PID controllers. Different control strategies used in steel plant
27. Principle of working of hydraulic & Pneumatic components and circuits. Proportional and servo hydraulics and its applications. Symbols of basic hydraulic and pneumatic components Interfacing of fluid power devices with electrical controller
28. Different types of raw material used for iron making and their sources. Iron and steel making processes. Hot and cold rolling process.
29. QMS and its important provisions. Concept and application of TPM. Quality Control tools and systems practiced in industries
30. Loading, unloading and shifting of common and uncommon shapes of material with the help of different lifting tools and tackles. Working at height. Reaving pulley block in different part. Communicate with crane operator through signals
31. Knowledge of Quality assurance required in Electrical works. Energy saving concept.
32. Demo on Microprocessor programming. Identification of different parts of a personal computer. Demo on industrial weighing system
33. Observation of different types of power electronic components Drawing the V-I characteristic of a thyristor. Construct different firing circuits of thyristors (RC, UJT, Ramp and Cosine firing circuits) and record the parameter. Construct single phase and three phase converter -half wave, full wave, half controlled etc. Construct different types inverter circuit and check the waveforms. Checking of power MOSFET, thyristors, IGBT, GTO, IGCT etc.
34. Testing and study of IGBT, power plate. Demo of a real time microprocessor based AC drive used in different processes in industries. Demonstration on parameterization of AC drives. Exercise on maintenance and trouble shooting of AC drive.

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

ELECTRICIAN (STEEL PLANT)			
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 rule	150 mm	Quantity to be sufficient as per seats surveyed & allocated
2.	Plier insulated	150mm	
3.	Plier side cutting	150mm	
4.	Screw driver	100mm	
5.	Screw driver	150 mm	
6.	Electrician connector screwdriver, insulated handle thin stem	100mm	
7.	Heavy duty screwdriver	200mm	
8.	Electrician Screwdriver, thin stem, insulated handle	250mm	
9.	Punch centre	150mmX9mm	
10.	Double bladed Electrician knife		
11.	Neon tester		
12.	Steel rule	300mm	
13.	Saw tenon	250 mm	
14.	Hammer, Cross peen with handle	115 gm	
15.	Hammer, ball peen with handle	750gm	
16.	Firmer chisel wood	12 mm	
17.	Gimlet	6mm	
18.	Bradawl		
19.	Scriber	150 mm X Ø 4 mm knurled centre position	
20.	Pincer	150 mm	
B : INSTRUMENTS & GENERAL SHOP OUTFIT			
21.	C. Clamp	200 mm, 150 mm and 100 mm. each	
22.	Spanner	150 mm adjustable 15 degree	
23.	Blow lamp	0.5 litre	

24.	Melting pot		Quantity to be sufficient as per seats surveyed & allocated
25.	Ladle		
26.	Chisel cold firmer	25 mm X 200 mm	
27.	Chisel	25 mm & 6 mm	
28.	Drill Machine hand	0 to 6 mm capacity	
29.	Electric drill machine portable	6 mm capacity	
30.	Pillar electric drill machine	12 mm capacity	
31.	Allen key		
32.	Oil can	0.12 litre	
33.	Grease gun		
34.	Out side micrometer	0 to 25 mm	
35.	Bench grinder motorised		
36.	Rawl plug tool & bit		
37.	Pulley puller		
38.	Bearing puller		
39.	Hygrometer		
40.	Thermometer	0 to 100 deg. centigrade	
41.	Scissors blade	150 mm	
42.	Crimping tool		
43.	Wire stripper	20 cm	
44.	Chisel cold flat	12 mm	
45.	Mallet hard wood	0.50 kg..	
46.	Hammer Exeter type	0. 40 kg.	
47.	Hacksaw frame	200 mm, 300 mm adjustable	
48.	Square try.	150 mm blade	
49.	Divider	150 mm, outside & inside calliper	
50.	Pliers flat nose	100 mm	
51.	Pliers gas round nose	100 mm	
52.	Pliers Gas	150 mm	
53.	Tweezers	100 mm	
54.	Snip straight	150 mm	
55.	Snip bent	150 mm	
56.	Spanner D.E. metric standard set		
57.	Drill hand brace	0 to 100 mm	
58.	Drill S.S. Twist block	2 mm, 5 mm 6 mm set of 3	
59.	Plane, smoothing cutters,	50 mm	
60.	Gauge, wire imperial		
61.	File flat	200 mm 2nd cut	
62.	File half round	200 mm 2nd cut	

63.	File round	200 mm 2nd cut	
64.	File flat	150 rough 4 nos.	
65.	File flat	250 mm bastard	
66.	File flat	250 mm smooth	
67.	Rasp, half round	200 bastard	
68.	Iron, soldering	25 watt, 65 watt, 125 watt	
69.	Copper bit soldering iron	0.25 kg.	
70.	Desoldering gun		
71.	Vice hand	50mm jaw	
72.	Vice Table jaw	100 mm	
73.	Vice Hand	150 mm jaw	
74.	Pipe cutter to cut pipes	upto 5 cm. dia	
75.	Pipe cutter to cut pipes above	5 cm dia	
76.	Stock and die set for	20 mm to 50 mm G.I. pipe	
77.	Stock and dies conduit.		
78.	Digital Multi meter	3 ½ digits	
79.	Digital Multi meter (	4 ½ digits	
80.	A.C. Voltmeter	M.I. 0 –500V A.C.	
81.	Milli-Voltmeter centre zero	100 – 0 – 100 m volt	
82.	D.C. Milli ammeter	0 – 500 mA	
83.	D.C. Ammeter	MC 0-1 A	
84.	Ammeter	MC 0-5 A	
85.	Ammeter	MC 0-15-25 A	
86.	A.C. Ammeter	M.I.. 0-5A	
87.	A.C. Ammeter	M.I.. 0-15-25A	
88.	K.W. Meter	0-1-3Kw	
89.	A.C. Energy meter	(single phase 5 amp. 230 V)	
90.	Single phase power factor meter		
91.	Frequency meter		
92.	Tacho meter with stop watch		
93.	Current transformer		
94.	Potential transformer		
95.	Growler		
96.	Tong tester / Clamp meter	0 – 100 Amp. AC.	
97.	Megger	500volts	
98.	Wheat stone bridge complete with galvanometer and battery		
99.	Relays – Over current, under voltage, etc.	3 volt, 100 amp.	
100.	Contactor 3phase, auxiliary contacts	440volt, 16amp. 2 NO & 2 NC	

101.	Contactor3 phase,	440 volt, 32 amp. 2NO & 2NCauxiliary contacts	
102.	Limit Switch		
103.	Rotary Switch	16A	
104.	Load bank	5 KW(Lamp / heater Type)	
105.	Brake test arrangement with two spring balance	0 to 25 kg rating	
106.	Knife switch DPDT fitted with fuse terminals	16 amp	
107.	Knife switch TPDT fitted with fuse terminals	16 amp	
108.	DC power supply	0 - 100 volt, 5 amp	
109.	Inverter	1 KVA Input 12 volt DC, Output 220 volt AC with 12 battery	
110.	Voltage stabiliser-	Input 150 – 230 volt AC, Output 220 volt AC	
111.	Rheostat	0 – 1 Ohm, 5 Amps. 0 – 10 Ohm, 5 Amps. ; 0 – 25 Ohm, 1 Amp; 0 – 300 Ohm. 1 Amp.	
112.	Resistance Temperature Detector	(Pt-100)	
113.	Digital Temperature Indicator (with RTD input)		
114.	Laboratory type induction coil	6 volt to 800-10,000 volt	
115.	3-point D.C. starters		
116.	4-point D.C. starters		
117.	Cut out, reverse current, over load, under voltage relays.		
118.	Starters for 3-phase, a) Direct on line starter b) Star delta starter with manual, semi-auto and automatic c) Auto transformer type starter	400 V, 50 cycles, 2 to 5 H.P. A.C. motors	
119.	Electrical machine trainer: -Suitable for demonstrating the construction and functioning of different types of DC machines and AC machines (single phase and three phase). Should be completed with friction brake, dynamo meter, instrument panel and power supply units		
120.	Motor generator (AC to DC) set consisting of – Motor induction squirrel cage, 7 HP 400		

	Volts, 50-cycles, 3-phase with star delta starter and switch directly coupled to DC shunt generator 5 KW 440 volts, and switch board mounted with regulator, air circuit breaker, ammeter, voltmeter knife blade switches and fuses, set complete with case iron and plate, fixing bolts, foundation bolts and flexible coupling.		
121.	Motor generator(DC to AC) set consisting of - Motor shunt 5 HP, 440 Volts with starting compensator and switch directly coupled to generator AC. 3.5 KVA, 400/230 Volts, 3-Phase, 4 wire, 0.8 PF 50cyccles with exciter and 1 switch board mounted with regulator, circuit breaker, ammeter, voltmeter frequency meter, knife blade switch and fuses etc. Set complete with cast iron bed plate, fixing bolts, foundation bolts and flexible coupling.		
122.	Used DC generators-series, shunt and compound type for overhauling practice		
123.	D.C. shunt generator,	2.5 KW, 220 V with control panel	
124.	D.C. compound generator, 2.5 K.W. 250 V, with control panel including filed rheostat, voltmeter, ammeter and circuit breaker		
125.	Diesel generator set	5 KVA, 44 volt, AC 3 phase with change over switch, over current circuit breaker and water-cooled with armature, star-delta connections.	
126.	Motor series DC, coupled with mechanical load	220 Volt, 0.5 to 2 HP	
127.	Motor shunt DC	220 volt, 2 to 3 HP	
128.	Motor DC compound wound:HP with starter and switch	220 volt 2 to 3	
129.	Motor AC squirrel cage	3-phase 400 volt, 50 cycles, 2 to 3 HP with star delta starter and triple pole iron clad switch fuse.	

130.	Motor AC phase-wound slip ring type	5 HP 400 volts, 3-phase, 50 cycles with starter and switch.	
131.	Motor A.C. series type	230V, 50 cycles, ¼ HP with mechanical load	
132.	Motor AC single phase	230 volt 50 cycles 1 HP capacitor type with starter switch 1 HP	
133.	Motor universal	230 volt, 50 cycles ¼ HP with starter/switch	
134.	Stepper motor with digital controller		
135.	Fan A.C.	230 volt 1200 mm	
136.	Transformer single phase,	1 K.V.A., 230 / 115-50-24-12 volts, 50 cycles core type, air cooled.	
137.	Transformer three phase,	5 K.V.A., 440/230 volts, 50 cycles, delta / star, shell type oil cooled.	
138.	Variable auto transformer	0-250 V, 8 amps.	
139.	Oscilloscope –Dual Trace,	30 MHZ	
140.	Function Generator		
141.	Discrete component trainer		
142.	Linear I.C.Trainer		
143.	Digital I.C.Trainer		
144.	Bath impregnating		
145.	Oven stoving		
146.	Oil testing Kit		
147.	Battery charger with variable output 1 KW		
148.	Hydrometer		
149.	A.C.B.	5 KVA	
150.	M.C.B.	16 amp.	
151.	Thyristor controlled D.C. motor drive 1 HP with tacho-generator feedback arrangement.		
152.	IGBT controlled A.C. motor drive with VVVF control ,	3 Phase 1 HP	
153.	Lockers with 2 drawers (standard size)		
154.	Bench working	2.5 x 1.20 x 0.75 meters	
155.	Almirah	2.5 x 1.20 x 0.5 meter	
156.	Instructor’s table		
157.	Instructor’s chair		
158.	Fire extinguisher		
159.	Fire buckets		

160.	Metal rack	100 x 150 x 45 cm	
161.	VCB – HT		
162.	Numerical relays		
163.	Portable temperature indicator	0-200 Deg C	
164.	Motor Checker		
165.	PLC with processor and I/O cards along with programming unit		
166.	Instrumentation tutor (LVDT, Strain gauge, RTD, Thermocouple, Thermistor)		

Note:

1. For each unit a **Trainee's Tool Kit** from Sl. No. 1 to 20 of the "Tool Kit" and locker is required.
2. If the two units are working simultaneously in any shift, additional **Shop's general outfit** from Sl. No. 1 to 98 of "Shop Tools, Instrument & Machinery" is required for the second shift.
3. For each two units in a shift, one set of Machinery and equipment from Sl. No. 99 to 146 are required.
4. *Some tools, instrument and equipment may be shared with other trades also.

TRADE: ELECTRICIAN (STEEL PLANT)
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 (700mm x500 mm) IS: 1444		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

Electrician (Steel Plant)

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.		

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	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	**Total internal assessment Marks**	**Result (Y/N)**
Maximum Marks (Total 100 Marks)			**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														