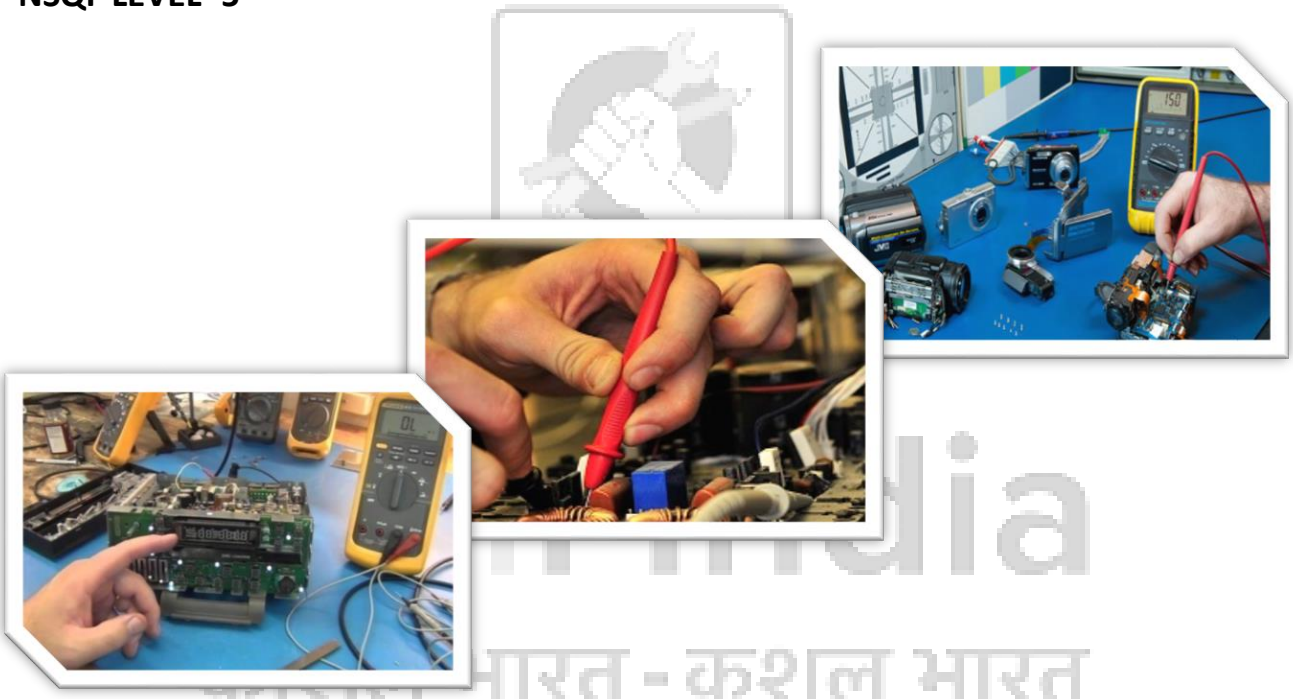
# ELECTRONIC MECHANIC (STEEL PLANT)

## COMPETENCY BASED CURRICULUM

**(Duration: 2 Yrs.)**

## APPRENTICESHIP TRAINING SCHEME (ATS)

**NSQF LEVEL- 5**



## SECTOR – ELECTRONICS

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

# ELECTRONIC MECHANIC (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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# ACKNOWLEDGEMENT

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

**Co-ordinator for the course:** Shri G. Venkatesh, ADT, ATI, Vidyanagar, Hyderabad

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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.

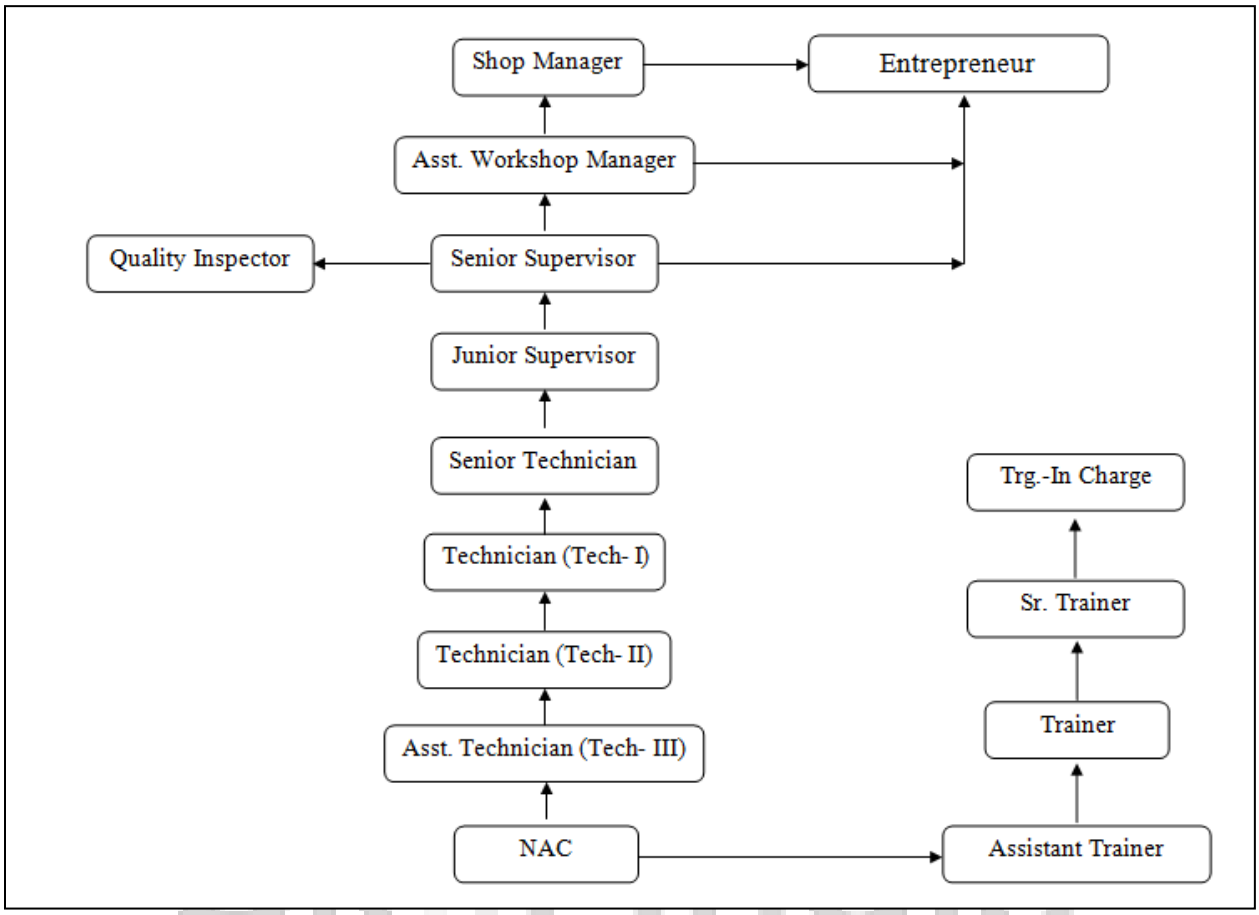
Electronic Mechanic (Steel Plant) trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills 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.
- Check the job/finishing and assembly as per drawing for functioning, identify and rectify errors in job/assembly.
- 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. 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

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<br>• Below 70% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards.<br>• A fairly good level of neatness and consistency in the finish<br>• Occasional support in completing the project/job. |
| (b)Weightage in the range of above75% - 90% to be allotted during assessment | |
| For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship. | • Good skill levels in the use of hand tools, machine tools and workshop equipment<br>• 70-80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards.<br>• A good level of neatness and consistency in the finish<br>• Little support in completing the project/job |
| (c) Weightage in the range of above 90% to be allotted during assessment | |
| For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship. | • High skill levels in the use of hand tools, machine tools and workshop equipment<br>• Above 80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards.<br>• A high level of neatness and consistency in the finish.<br>• Minimal or no support in completing the project. |

# 3. JOB ROLE

**Brief description of Job roles:**

**Electronics Fitter**, General fits, assembles and repairs various kinds of electronic equipment in factory or workshop or at place of use. Examines drawings and wiring diagrams; checks parts for accuracy of fit and minor adjustments; assembles parts or mounts them on chassis or panels with aid of hand tools; installs and connects wiring, soldering joints equipment, diagnoses faults with aid of electronic testing equipment; dismantles equipment if required and replaces faulty parts or wiring.

**Electronics Mechanic**; Electronic Equipment Mechanic repairs electronic equipment, such as computers, industrial controls, radar systems, transmitters, and telemetering control systems following blueprints and manufacturer's specifications and using hand tools and test instruments. Tests faulty equipment and applies knowledge of functional operation of electronic units and systems to diagnose cause of malfunction. Tests electronic components and circuits to locate defects, using instruments, such as oscilloscopes, signal generators, ammeters and voltmeters. Replaces defective components and wiring and adjusts mechanical parts, using hand tools and soldering iron. Aligns, adjusts and calibrates testing instruments. Maintains records of repairs, calibrations and test. May install equipment in industrial or military establishments and in aircraft.

**Electronic Mechanics and Servicers, other** include all other workers engaged in installing, servicing and repairing radios and television sets and other audio equipment, not elsewhere classified.

**Reference NCO 2015**:

(i) 7421.0100 – Electronics Fitter, General
(ii) 7421.0300 – Electronic Mechanic
(iii) 7421.9900 – Electronic Mechanics and Services, Other

# 4. NSQF LEVEL COMPLIANCE

NSQF level for Electronic Mechanic (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 Electronic Mechanic (Steel Plant) trade 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** | ELECTRONIC MECHANIC (STEEL PLANT) |
| **NCO-2015** | 7421.0100, 7421.0300, 7421.9900 |
| **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<br>b) Block – II : 3 months<br>**Total duration of Basic Training: 6 months** |
| **Duration of On-Job Training** | a) Block–I: 9 months<br>b) Block–II : 9 months<br>**Total duration of Practical Training: 18 months** |
| **Entry Qualification** | Passed 10th class examination under 10+2 system of education or its equivalent. |
| **Selection of Apprentices** | The apprentices will be selected as per Apprenticeship Act amended time to time. |
| **Instructors Qualification for Basic Training** | As per ITI instructors qualifications as amended time to time for the specific trade. |
| **Infrastructure for Basic Training** | As per related trades of ITI |
| **Examination** | The internal examination/ assessment will be held on completion of each block.<br>Final examination for all subjects will be held at the end of course and same will be conducted by NCVT. |
| **Rebate to Ex-ITI Trainees** | 01 year |
| **CTS trades eligible for Electronic Mechanic (Steel Plant) Apprenticeship** | 1. Electronics Mechanic |

***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

## 6.1GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Electronic Mechanic (Steel Plant) 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. Identify characteristics of DC motor of all types, testing DC motors, identifying terminals, connecting, running and reversing of rotation of DC motors.
2. Identify types of transformer and its parts, verify their different features, test different transformers, and perform cleaning, maintenance, oil testing etc.
3. Dismantle, inspect parts, clean and test windings, lubricating bearings and assembling of 3-phase SC and SR motors.
4. Test induction motor by megger and Motor Checker.

5. Perform dismantling and re-assembling the electromagnetic AC contactors of different voltages, types, makes and categories.
6. Set different types of motor protection relays.
7. Identify terminals of alternator, connecting, starting, running, loading and plotting characteristic curves.
8. Start synchronous motors by different methods.
9. Check Programming on Microprocessor/Microcontroller.
10. Identify different parts of a personal computer.
11. Identify different types of power electronics components.
12. Identify different firing circuits of thyristors (RC, UJT, Ramp and cosine firing circuits).
13. Use single phase and three phase converter- half wave, full wave, half controlled etc.
14. Check power MOSFET, thyristors, IGBT, GTO, IGCT, IGBT, power diode etc.
15. Identify a real time microprocessor based AC drive used in different processes in industries & carry out maintenance and troubleshooting of AC drive.
16. Verify working principal and characteristic of different sensors and transducers viz. LVDT, strain gauge, capacitive gauge, thermocouples, RTDs thermistors etc.
17. Configure smart transmitter using HART and other configurations & operate a controller, setting of its PID values, controller tuning.

**Block – II**

18. Identify different I/O modules of PLC, develop simple programmes involving bit level instructions, timers and counters, simple data manipulation instruction, feeding and running the programmes in PLC, I/O forcing.
19. Identify hardware of DCS, process operation using DCS.
20. Identify different components such as reservoir, fitter, pumps, float switch, valves, actuators etc. & Operate proportional and servo valves, functions of control and feedback components.
21. Identify simple hydraulic & pneumatic devices and circuits, reading and interpretation
22. Fabricate electronic circuits on assembly and test power supply with filter and regulators on PCB by soldering the components.
23. Perform soldering and de-soldering SMDs/ICs, test different types of sensors, transducer and switches.
24. Perform testing and maintenance of electronic modules such as rectifiers, amplifiers, oscillators, logic circuits, multivibrator, multiplexer, timers, voltage regulators, ADC, DAC etc.
25. Repair defective electronics equipment such as power suppliers, microprocessor based circuits, weighing system, PA system, communication equipment including fiber optic communication modules.

26. Identify various types of power transmission equipment/ devices- Conductors, support, insulators and cables.
27. Check connection of relays, maintenance and adjustment of arc chute and contact.
28. Check Emission and pollution control equipment, dust handling & disposal system, effluent treatment plants, emission monitoring equipment.
29. Carry-out repair/ test/ calibration of instruments/equipment/ maintenance job under the guidance of competent person, work with skilled supervisors/ workmen/ operators & prepare report on the job done.

***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 | 2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction. |

| | |
|---|---|
| apply in day to day work.*[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]* | 2.2 Measure dimensions as per drawing |
| | 2.3 Use scale/ tapes to measure for fitting to specification. |
| | 2.4 Comply given tolerance. |
| | 2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials. |
| | 2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges. |
| | 2.7 Explain basic electricity, insulation &earthing. |
| | |
| 3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]* | 3.1 Read & interpret the information on drawings and apply in executing practical work. |
| | 3.2 Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters. |
| | 3.3 Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work. |
| | |
| 4. Select and ascertain measuring instrument and measure dimension of components and record data. | 4.1 Select appropriate measuring instruments such as micrometers, verniercalipers, 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 |
| | |
| 6. Explain energy conservation, global warming and pollution | 6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available |

| | |
|---|---|
| and contribute in day to day work by optimally using available resources. | 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** | |
| **<u>Block-I & II (Section:10)</u>** | |
| *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 | Plant visit to observe steel making process & machineries used in steel plant. Use of Personal Protective Equipment. Rule & regulation of the institute. Usage of First aid box Practice of Cardiopulmonary Usage of Resuscitation (CPR) - Fire extinguishers -Safety appliances-personal protective equipment (PPEs), gas detector, gas mask, oxy-pack etc. (specific to steel industries) | Familiarization with the Institute & steel industry. Machinery used in the trade and type of work done by the trainees in the trade. Importance of safety, general safety precautions observed in the Institute and in the section. Importance of the trade & trade training, Related instructions & subjects to be taught. Salient features of Apprentices' Act. Introduction to general, behavioural and Road safety Overview of steel manufacturing process. Introduction of first aid. Causes and type of fires, fire precautions against outbreak of fire, different type of fire extinguishers and their uses. Precautions while working at height. Gas safety Electrical safety Quality-brief introduction of improvement techniques followed in the organization-Small group activities (SGA), Quality Circle (QC) and its tools |
| 2 | **Hacks awing** - Marking lines, Cut metals pieces of different profiles & sections by hack-sawing (straight, inclined & curved line) to an accuracy of 0.5 mm. **Filing** - Parallel filing practice on flat surface Marking practice of straight, parallel and curved lines with odd leg calipers, steel rule, dividers, Scriber. Filing flat, square, steps and contour surfaces to an accuracy of 0.2 mm. **Marking** - Transfer of dimensions from drawing to work pieces. Finding center of a round bar with the help of „V" block and marking block. **Chipping** - Chipping practice on flat surface, slots & oils grooves, and chamfer at different angle on MS | Classification, constructional and functional details of different type of **bench and machine vices.** Care of vices. Classification, construction and functional detail of **Hammers.** Classification, construction and functional detail of following **cutting tools:** Chisels, Hacksaw, Files, Drills, Reamers, Scrapers, Taps & Dies. Classification, construction and functional detail of following **bench tools** : Steel rule, Try square, Calipers, Divider, Centre punch, Surface plate, V-Block and Trammel etc. **Marking media,** marking blue, Prussian blue, red lead, chalk and their special application, description. **Measuring Instruments:** Micrometer (outside and inside) - working principle, use and care, Calculation of least count. Vernier calipers, principle, graduations, reading, use and care. **Elements of mechanical components:** |

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| | plate.<br>**Drilling & Reaming** - Use of drilling machine for drilling through & blind holes, Reaming of drilled hole by hand reamer.<br>**Internal & external threading** by Taps & Die Dismantling, inspection and re-assembly of bearings, coupling and keys Practice on leveling, alignment, static balancing and plumbing related to electrical machines including Laser alignment. Practice on lubrication related to electrical machines. | bearing, coupling and keys **Basic knowledge of gear and gear boxes Leveling and alignment** of electrical machine Lubrication related to electrical machines. |
| 3 | Demonstration and use of electrical measuring instruments with safety aspects Verification of Ohm"s law Verification of law of series and parallel circuits Verification of Kirchhoff"s law Measure resistance by using voltmeter and ammeter, post-office box, AVO meter, Standard resistance comparison, bridge, megger and potentiometer | **Fundamentals of electricity,** electron theory, concept of free electrons and difference between conductor, insulator and semi-conductor. Definition and units of voltage, current, resistance, power and energy **Ohm's law,** simple electrical circuits and problems. Resistance- series and parallel, laws of resistance, temperature co-efficient of resistance, work, power and energy. Kirchhoff"s current & voltage laws and application, Wheatstone bridge and its application, Simple problems Use of common electrical measuring instruments and related safety aspects |
| 4 | Perform experiments to draw B-H curve. Prepare simple electromagnet and find the polarity Experimenting Faraday"s laws, Lenz"s law, Fleming"s rules, self and mutual inductance Determining hysteresis loss and eddy current loss. | **Magnetism-** classification of magnets, methods of magnetizing, magnetic material, Coulomb"s law, permeability, ferro, para and diamagnetic materials<br>**Electromagnetism-** Solenoid, field around conductors carrying current, polarity, screw-rule, right-hand grip rule, advantages and application of electromagnet.<br>**Magnetic series and parallel circuits,** B-H curves, hysteresis loop, hysteresis loss, eddy current, eddy current loss, equations and problems.<br>**Principles of electromagnetic induction,** Faraday"s laws, Lenz"s law, Fleming"s Rules, Related safety aspects |

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| 5 | Connect the capacitors in series and parallel and measure different values. Observation of charging and discharging of capacitors, its testing. Grouping of dry cells for a specific voltage and current. Battery charging- Prepare electrolyte for lead-acid storage battery; charge the battery using different methods, Check for battery condition. Routine care and maintenance of batteries | Self-inductance, mutual-inductance, their co-efficient, equations and problems.<br>**Joule's law of heating,** Joule"s equivalent, heating appliances and elements. **Electrostatics-** terms and definitions, coulomb"s law, capacitors, charging and discharging of capacitors, energy stored.<br>**Chemical effect of electricity** - principle of electrolysis, Faraday"s laws. Applications of electrolysis, Basic principles of electroplating Principle and construction of simple voltaic cell, Leclanche cell, dry cell, standard cells, their uses, care, maintenance and grouping.<br>**Secondary cells** principle, types, lead-acid cells, description of parts, chemical action, method of charging, rate of charging, testing equipment, hydrometer, high rate of discharge tester, capacity, general defects and their remedies. Re-chargeable dry cells . Related safety aspects. |
| 6 | Use of CRO/DSO Observation of different types of AC waves and measurement of their different parameters by oscilloscope.<br>**AC series and parallel circuits** Determining L for a coil and choke and C for a capacitor. Observation of 3-phase voltages and measurement of voltage, connections in star & delta. | **Alternating Current-** comparison between DC and AC, its related terms, waveform, frequency and phase, instantaneous, RMS, average values Resistance, inductance and capacitance in AC circuits, reactance and impedance, power factor, vector diagram, active and reactive power. Simple problems. Related safety aspects.<br>**AC series and parallel circuits** - RL, RC and RLC. Power factor and resonance.<br>**Poly phase systems,** its advantages over single-phase system. Star and delta connections in 3-phase system, relationship of VL, VP, IL, IP, formulae and calculations. Related safety aspects. |
| 7 | Demonstration of three-phase load and measurement of voltage, current power & power factor in 3-phase circuit. Familiarization with safe working practice with electrical equipment. Identification and study of parts of a DC Machine Identifying terminals of DC machine by measuring resistance of shunt field, series field and armature | **Power and power factor in 3-phase circuits,** active and reactive power, methods of improvement of power factor. Balanced and unbalanced loads.<br>**Measurement of power and energy** in 3-phase, 3-wire and 3-phase-4 wire circuits. Related safety aspects.<br>**Types of electrical machines. DC generator-** working principle, EMF equation, electromagnetic drag, types, and parts, Self |

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| | Connecting, running and studying the characteristics of DC series, Shunt, and compound generators. Study of No-load and load characteristics. Finding critical resistance and critical speed of DC generators. | and separately excited generators, practical uses Explanation of armature reaction and commutation, interpoles and their uses, connections and polarity. Characteristics of series, shunt, compound and separately excited generators, critical resistance and critical speed, application of DC generators, Losses and efficiency.<br>**DC motor-** working principle, torque, speed, back emf, their relations. Types of DC motors-series, shunt, compound and separately excited their characteristics and applications. Starting and speed control of DC motors. Related safety aspects. |
| 8 | Identification of types of transformers and its parts. Verification of transformation ratio, loading secondary, finding relation between primary and secondary currents, voltages and no. of turns Measurement of iron and copper losses, determination of regulation, efficiency etc., polarity marking of single-phase and three-phase transformers. Testing of single and three phase transformers, cleaning and maintenance, oil testing. Study of Instrument transformers - CT, PT and Tong-tester. | **Transformers-** working principle, transformation ratio, no-load and on-load phasors, classification, types of core, EMF equation, equivalent resistance, reactance and impedance; equivalent circuits. Open and short-circuit tests, regulation, losses and efficiency of transformers. Three-phase transformers- types, construction, applications, advantages and connections, Protective devices and cooling systems of Transformers. Auto-transformers, Instrument transformers -CT, PT, Tong-tester and their applications. |
| 9 | Dismantling, inspection of parts, cleaning and testing of windings, lubricating bearings and assembling of 3-phase SC and SR motors. Polarity marking (phase-sequence test) of a 3-phase induction motor and connection in star and delta. Testing induction motor by megger, and Motor Checker. Starting the motor using different starters, running and reversing the motor, measuring the starting and no-load currents, measuring speeds at different loads, calculating speed etc. Dismantling, studying and re- | **Induction motors-** Rotating magnetic field, and working of 3-phase induction motors, production of torque. Construction of SC and SR motors, slip, rotor emf, current, frequency, pf, Cu loss, Slip torque characteristics. Double-cage rotor, comparison of SC and SR motors. Starters of induction motors and its necessity, types-DOL, star-delta, auto-transformer, soft-starters and rotor resistance starters of wound-rotor induction motors. Use of motor Checker Protective devices in AC motor circuits -Principle and setting of over-current relays-thermal, magnetic, EOCR and numerical relays. Single-phasing-its effects and prevention, NVR and its function. Single-phase |

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| | assembling the electromagnetic AC contactors of different voltages, types, makes and categories. Settings of different types of motor protection relays. Doing panel wiring by using contactors relays etc. for automatic star-delta, autotransformer, rotor-resistance, and forward-reverse D.O.L. starters. Studying, overhauling of fan motors, connecting, running and reversing of single-phase motors. Identification of terminals of alternator, connecting, starting, running, loading and plotting characteristic curves. Starting synchronous motors by different methods. | induction motors - theory of rotation and self-starting, types, reversal and speed control. Related safety aspects.<br>**Synchronous machines Alternator-** parts, types of poles- salient pole and smooth-cylindrical type, rotating-field and rotating armature type etc. Prime movers for alternators, turbo-alternator, engine-driven alternators, EMF equation, pitch-factor, breadth-factor. Alternator characteristics, OCC, SCC, Exciter, Excitation, and voltage regulation, cooling of alternators and rating. Synchronous motors: operation, types, characteristics, application. Related safety aspects. |
| 10 | Electronic Component identification and testing, Reading and interpretation of colour codes of components. Use of digital multimeters. Connecting function generator with oscilloscope, study of wave forms, measurement of voltage and frequency. Diode characteristic, Zener diode characteristics, testing, and identification. **Making half wave and full wave rectifiers** using training kits, study of different wave shapes and their values on oscilloscope. Soldering and desoldering practice **Transistors: identification and testing** finding static and dynamic characteristics of transistors in different modes using training kits, calculation of gains. Biasing circuits. Identify, test of FET, MOSFET and UJT. | **Basic Analog Electronics** – Introduction to Electronics and its application, difference between analog and digital electronics. Atomic theory, energy band diagram, classification of matter based on energy band diagram.<br>**Active and passive circuit elements**: **Resistors and their rating -** fixed and variable, carbon and wire wound, metal film and metal oxide, colour coding, power rating, accuracy and effect of temperature, uses of resistors.<br>**Fuses and their rating**- Slow blow and fast blow, semiconductor fuse.<br>**Inductors and their rating -** types: ferrite core, air core, tapped and variable inductors. Factors affecting inductance and use of inductors.<br>**Capacitors and their rating**: Mica, ceramic, paper, electrolytic, tantalum, silvered mica, variable capacitors, colour coding and uses.<br>**Voltage and current sources**- Ideal and practical, AC and DC signal and its source.<br>**Semiconductor theory**: intrinsic and extrinsic, P and N type, development of P-N junction, drift and diffusion currents, barrier potential, biasing arrangement. Effect of temperature.<br>**Diodes**: working, classification, characteristics, |

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| | | coding, specification, identification and testing. Half wave and full wave rectifiers, PIV.<br>**Zener diodes**: characteristics, types and application. Calculation of series resistance for varying inputs and load currents, Voltage regulator using zener.<br>**LED, varactor and photo diodes**- working principle and applications.<br>**Transistors:** working, classification, VI characteristics (static and dynamic), CE, CB.<br>**Field effect transistors**: construction, operation and VI characteristics of JFET, Enhancement and deletion type MOSFET, concepts of CMOS, Difference with bipolar junction transistors, uses.<br>**UJT-** Construction, operation VI characteristics and application. |
| 11 | **Assembly and testing of amplifier circuits on PCB:** Single stage CE, CB, CC amplifiers, RC, Transformer and direct couple amplifiers. Assembly of oscillator circuits using transistor and measuring the output frequency and waveform.<br>**OPAMPS** pins identification, assembly of inverting and non-inverting amplifiers, calculation of voltage gain, assembly of comparator, adder, subtractors, differentiator, integrator, V/I and I/V circuit and its testing. **Construction of multivibrators using 555 timers**, Verification of truth tables of different gates Realization of different Boolean expression with logic gates. Realization of adders and subtractors Construct and verify truth tables of flip flops. Construct synchronous and asynchronous counters and study its functions. Construct controlled shift register and study their functions. Practice on reading and interpretation of IC data sheets. | **Amplifiers:** working principle, classification and circuits. Small signal single stage AF/RF amplifiers: different circuits, load line, voltage, current and power gain, waveforms, frequency response.<br>**Multistage amplifiers**- need and types of coupling. RC, transformer and direct couple amplifier circuits, voltage and power gain, frequency response, bandwidth, comparison between different types.<br>**Power amplifier**- voltage and power amplifier, classification Class A, B.C and AB amplifier circuits.<br>**Push-pull amplifier**, Use of heat sink., harmonic distortion and its control.<br>**Feedback amplifiers** circuit and applications.<br>**Oscillators**: working principle, classification, circuits and applications. Factors controlling oscillation. Different types of oscillators, their characteristics and applications, crystal oscillators.<br>**Linear ICs and OP-AMPs**: working, characteristic, pin diagram, applications as inverting and non-inverting amplifier, calculation of gain, comparator, unity gain buffer and scale changer, adder, subtractor, differentiator, integrator, V/I and I/V converter. Differential and Instrumentation |

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| | | amplifier.<br>**Switching and timer circuits**: classification of multi-vibrators, astable, monostable and bistable. Internal block diagram, operating of 555 timers and its applications.<br>**Opto-electronics**- elementary idea of LED, LCD, photo diodes, photo transistors, solar cells and their applications.<br>**Digital Electronics Number systems**: binary, octal, hex, 1's and 2's complements, conversion from one system to other, Boolean algebra: De Morgan theorem and its applications.<br>**Basic logic gates**: Symbolic representation and truth tables for logic gates: Buffer, NOT, OR, AND, NAND, NOR, XOR, XNOR. Different logic families and their characteristics, Electrical equivalent of gates, Negative and positive logic gates.<br>**Boolean algebra-** Karnaugh map technique, simplification of Boolean expressions, realization of Boolean expression with logic gates.<br>**Combinational logic circuits**: Half and full adder and subtractors. Encoders, decoders, multiplexer, de-multiplexers, parity generators and checker.<br>**Sequential logic circuits**: Difference between sequential and combinational circuits, triggering of sequential circuits. Flip-flops: RS, JK, D, T type, preset and clear signals, timing diagrams. Counters, Registers and its applications.<br>**Data converters:** Digital to analog converters, simple circuits, and applications. Analog to digital converters.<br>**Multivibrators:** Types, characteristics and circuits, Schmidt trigger.<br>**Microprocessor and computer:** Organization in general: CPU, ALU, resistors, counters, data and address process, memory and I/O devices. Instruction set, Simple programming. Introduction to other processors. Hardware of a personal computer (PC).<br>**Microcontrollers**: basic principle, architecture, |

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| | | types, programming concepts, interfacing. |
| 12 | Observation of different types of power electronic components. Drawing the V-I characteristic of a thyristor. Study of different firing circuits of thyristors (RC, UJT, Ramp and Cosine firing circuits). Study of 1 ph and 3 ph converter - half wave, full wave, half controlled etc. Study of inverter circuit and waveforms. Checking of power MOSFET, thyristors, IGBT, GTO, IGCT etc. Testing of thyristor and Ramp firing circuit, study of waveform on different test points of ramp firing circuits. Testing and study of IGBT, power plate. Study of inverter voltage waveforms. 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. | **Power electronic devices**: Thyristor, its construction, characteristics and family. Power diodes and power transistors, power MOSFET, IGBT, GTO, IGCT and their applications. **Thyristor circuits:** Converter, AC voltage Regulator, Chopper, Inverter, IGBT circuit, PWM and their use.<br>**Electric Drives:** Concept of modern electric drives, Classification of load and motor according to their speed/torque characteristics and drive performance characteristics. Behavior of drive system during change of state Control system - concept of open and closed loop system.<br>**DC drives**: concept of speed control of DC motor. Block diagram of close loop unidirectional DC drive, four quadrant operation of DC drive, concept of dual converter, block diagram of close loop reversible DC drive, field weakening control and spill over control, Electronic modules used in DC drives. Parameters and concept of parameterization of DC drives. Maintenance and trouble shooting of DC drive. Related safety aspects.<br>**AC drives**: concept of speed control of AC motors, principle of V/f control of drives, block diagram of close loop AC drive, principle and operation of inverters (1 ph and 3 ph)- concept of PWM inverter. Principles of speed control of SCIM and SRIM in AC drives. Block diagram of Close loop control, power circuit, control circuit, electronic control modules of AC drive. Parameter and Concept of parameterization of AC drives. Maintenance and trouble shooting of AC drive Related safety aspects. |
| 13 | **Revision & Examination** | |

**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) |
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| 1 | Verification of working principle and characteristic of different sensors and transducers covered in theory class viz. LVDT, strain gauge, capacitive gauges, thermocouples, RTDs, thermistors etc. Dismantling, assembly, overhauling and calibration of transmitters, indicators, gauges, regulators and switches used for pressure, temperature, flow, level and other measurement. Configuration of smart transmitters using HART and other configurations. | **Introduction**- Objective of the Instrumentation & control, elements of measurement systems, instrument terminology. Sensors and transducers– definition and types Load cell and its application in industrial weighing. Encoders and its applications.<br>**Introduction to process parameter measurement: Temperature measurement**- Principles, types and working of mechanical, electrical and radiation temperature sensors, relative advantages and limitations. **Temperature switches**: constructional details and maintenance.<br>**Temperature transmitters**: types, working, calibration and maintenance. Hot metal detectors, Molten metal (Bath) temperature measurement.<br>**Pressure measurement**- types and units of pressure and differential pressure. **Manometers:** principles, types and working. **Pressures sensors and transducers**: working principle and construction of elastic and electrical pressure and DP sensors.<br>**Pressure gauges**: constructional details, calibration and maintenance.<br>**Pressure switches**: constructional details and maintenance.<br>**Transmitters:** Smart P/DP transmitters and its configuration.<br>**Flow measurement**: Definition, units and types.<br>**Restriction method**: principles, types and installation of orifice plate, venturi tube, flow nozzle and others sensors.<br>**Variable area method**: principles, types, and working. Mass flowmeters, magnetic, turbine and vortex flowmeters.<br>**Flow switches**: constructional details and maintenance. |

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| | | **Level measurement** - definition, units and types of liquid and solid level measurement using direct and indirect methods: hydro-static pressure, capacitive ultrasonic, air bubbler.<br>**Thickness measurement:** types of methods, working principle, construction, calibration and maintenance. Related safety aspects. |
| 2 | Operation of a controller, setting of its PID values, controller tuning. Testing of a control valve, I/P converter and valve positioners. 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. | **Process Control System** Introduction, process variables, manual and automatic, close loop and open loop process control systems, process disturbances.<br>**Controller –** types, P, D & I control actions. Tuning of a controller.<br>**Final control elements**: types, working principle, construction, calibration and maintenance of I/P converters, Control valves & actuators, Valve positioned, power cylinders.<br>**Reading and interpretation of PI diagrams**, instrument manuals and part list, panel wiring diagram etc. Related safety aspects.<br>**Programmable Logic Controller (PLC)**- Need and working principle, hard ware details. Function and connections of different cards.<br>**Program techniques** of PLC, inputs, outputs, timer and counter instructions, data manipulation.<br>**Development of simple programs** Documentation, different functional blocks & mathematical instructions.<br>**Communication system** used in networking of PLC.<br>**Data Acquisition System (DAS) & Supervisory Control And Data Acquisition (SCADA) System**- Basic structure, software and applications, introduction to HMI packages.<br>**Distributed Control System (DCS)-** basic concepts, architecture advantages.<br>**Level of automation** in steel industry. Related safety aspects. |
| 3 | Identify components such as reservoir, filter, pumps, float switch, valves, actuators etc. Operation of proportional and | **Industrial hydraulics and pneumatics** Basic principles of hydraulics and pneumatics, characteristic of fluid media, safety aspects Operational details of fluid power control |

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| | 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. | 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. Concepts of interfacing of hydraulic and pneumatic components with PLC. |
| 4 | Fabrication of electronic circuits on **Assembly and testing of power supply** with filter and regulators on PCB by soldering the components. Demonstration on soldering and de-soldering SMDs. Study of SMPS, UPS and Inverter circuits and its testing. Study of PC hardware and peripheral devices. Study of industrial camera and CCTV used in steel plants. | **Different techniques of electronic circuit fabrication Surface mounted devices** technology, microelectronics. **Regulated power supply**. Introduction to SMPS and UPS. Understanding of specification. **PC** hardware including I/O devices, memories Working principle and types of **industrial camera and CCTV** |
| 5-6 | Study of welding machine and CNC control circuit Study and testing of different types of sensors, transducer and switches. Demonstration of different units of an industrial weighing system. Testing and maintenance of electronic modules such as rectifiers, amplifiers, oscillators, logic circuits, multivibrator, multiplexer, timers, voltage regulators, ADC, DAC etc. Repair and maintenance practices on defective electronic equipment such as power supplies, PC, microprocessor based circuits, CCTV, industrial camera, weighing system, PA system, modem etc. Repair and maintenance of communication equipment including fibre optic communication modules. **(Note- Trainees should be given defective electronic equipment for repair)** | **CNC machines**- basic idea. **Sensors and switches**- Proximity switch, Micro switch, limit switch, photo switch, encoder and other types of electronic sensors and their application. **Industrial weighing system**- types, different types of load cell and processing units, configuration, maintenance and trouble shooting. Safety precautions. Requirement of grounding of self and equipment. Working principles, block diagram, circuit diagram and applications of following electronic test & measuring instrumentsa. a. Multimeter b. CRO- conventional and storage type c. Scope meter d. DC power supplies e. Function generators f. Pulse generators g. Temperature controlled soldering and desoldering stations etc. h. IC tester Modern trouble shooting techniques and use of electronic test equipment for service and repairing of electronic cards and equipment, use of test rigs and jigs, component substitution in handling of PCB and hybrid circuits. |

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| 7-8 | Measurement of pit resistance. Demonstration of HV safety devices. Use of HV tester, cool coat, discharge rod. Study of various types of power transmission equipment/ devices – conductors, support, insulators and cables. Cable jointing practices. Study of single line diagram of interconnected industrial power supply system. Polarity marking of CT. Connection of CT and PT. Connection of lightening arrestors. | **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. Earthing, system and equipment, neutral earthing, maintenance of earth pits. Related IE rules and safety aspects. Transmission O/H line, conductor, support, insulators, their merit and demerit, sag, span, joints, guard, binding of insulators, stay, damper jumpers, erection of line, maintenance and inspection of transmission lines.<br>**Cables**- construction, classification of cables, property of XLPE, paper, PVC, insulation, jointing and laying of cable, testing and fault localization.<br>**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.<br>**LDC-** monitoring system for power generation and utilization.<br>**Indian electricity rules** pertaining to safety of supply system, LT and HT equipment, O/H transmission. Related IE rules and safety aspects. |
| 9 | Connection of relays, Maintenance and adjustment of arc chute, and contact Opening and assembling - pole assembly, trip assembly and hand assembly. Maintenance of ACB, OCB, VCB, and SF6 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 |

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| | | protection relay, numerical relays used with power system. Related IE rules and safety aspects. |
| 10 | Demonstration of different types of fuses. Demonstration of different types of power factor improvement and compensation equipment. Visit to Energy Management Centre such as Load Despatch Centre (LDC), Sub-stations. | **Fuse**- terms and definitions, selection and characteristic of HRC fuse.<br>**Power factor**- effect of low power factor, cause of low PF, power factor improvement, use of static VAR compensation.<br>**Energy management**- maximum demand, load factor, connected load, diversity load curve, tariff. Related IE rules and safety aspects. |
| 11 | Preparation of a word document (eg. Project report). Preparation of an excel file and make graphical representation of data obtained during practical sessions on electricity. | **Computer & IT** Basics of computer hardware and software MS office: Word, Excel and power point Use of Intranet, Internet, E-mail. |
| 12 | Guided visit of different plants of the organization and familiarization with the process. Familiarization with Quality Management System, TPM, Small Group Activity (SGA) and Quality Circles as being practice in the industry. | 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. 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. |
| 13 | **Revision & Examination** | |

**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. SYLLABUS - CORE SKILLS

## 9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

| Block – I | | |
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| **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, Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems - 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. |
| 5. | **Percentage:** Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa. | **Free Hand sketch:** Hand tools and measuring instruments used in electronics mechanics trades |
| 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, | **Free hand drawing:** - Lines, polygons, ellipse, etc. - Geometrical figures and blocks with dimension. -Transferring measurement from the given object to the free hand sketches. |

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| | Non- Ferrous metals, Non-Ferrous Alloys. | |

| **Block – II** | | |
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| **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** |
| 3. | **Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables). | LED, IRLED, photo diode, photo transistor, opto-coupler symbols symbol of Logic gates |
| 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. | Half adder, full adder, multiplexer and de-multiplexer |
| 5. | **Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding height and distance by trigonometry. | UJT, FET, MOSFET, DIAC, TRIC, SCR, IGBT symbols and circuits of FET Amplifier, SCR using UJT triggering, snubber circuit, light dimmer circuit using TRIAC, UJT based free running oscillator. |

## 9.2 EMPLOYABILITY SKILLS

**(DURATION: 110 HRS.)**

| **Block – I (Duration – 55 hrs.)** | |
|---|---|
| **1. English Literacy** | Duration : 20 Hrs.<br>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.<br>Marks : 09 |
| **Basics of Computer** | Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer. |
| **Computer Operating System** | Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications. |
| **Word processing and Worksheet** | Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document.<br>Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets. |
| **Computer Networking** | Basic of computer Networks (using real life examples), Definitions of |

| | |
|---|---|
| **and Internet** | Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks),<br>Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication.<br>Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes. |
| **3. Communication Skills** | Duration : 15 Hrs.<br>Marks : 07 |
| **Introduction to Communication Skills** | Communication and its importance<br>Principles of Effective communication<br>Types of communication - verbal, non verbal, written, email, talking on phone.<br>Non verbal communication -characteristics, components-Para-language<br>Body language<br>Barriers to communication and dealing with barriers.<br>Handling nervousness/ discomfort. |
| **Listening Skills** | Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.<br>Triple- A Listening - Attitude, Attention & Adjustment.<br>Active Listening Skills. |
| **Motivational Training** | Characteristics Essential to Achieving Success.<br>The Power of Positive Attitude.<br>Self awareness<br>Importance of Commitment<br>Ethics and Values<br>Ways to Motivate Oneself<br>Personal Goal setting and Employability Planning. |
| **Facing Interviews** | Manners, Etiquettes, Dress code for an interview<br>Do's & Don'ts for an interview. |
| **Behavioral Skills** | Problem Solving<br>Confidence Building<br>Attitude |
| **Block – II**<br>**Duration – 55 hrs.** | |
| **4. Entrepreneurship Skills** | Duration : 15 Hrs.<br>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.<br>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.<br>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.<br>Accident Prevention techniques - control of accidents and safety |

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|---|---|
| | measures. |
| **First Aid** | Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person. |
| **Basic Provisions** | Idea of basic provision legislation of India.<br>safety, health, welfare under legislative of India. |
| **Ecosystem** | Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance. |
| **Pollution** | Pollution and pollutants including liquid, gaseous, solid and hazardous waste. |
| **Energy Conservation** | Conservation of Energy, re-use and recycle. |
| **Global warming** | Global warming, climate change and Ozone layer depletion. |
| **Ground Water** | Hydrological cycle, ground and surface water, Conservation and Harvesting of water. |
| **Environment** | Right attitude towards environment, Maintenance of in -house environment. |
| **7. Labour Welfare Legislation** | Duration : 05 Hrs.<br>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.<br>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-JOB TRAINING)

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

**Block – I**

1. Identify characteristics of DC motor of all types, testing DC motors, identifying terminals, connecting, running and reversing of rotation of DC motors.
2. Identify types of transformer and its parts, verify their different features, test different transformers, and perform cleaning, maintenance, oil testing etc.
3. Dismantle, inspect parts, clean and test windings, lubricating bearings and assembling of 3-phase SC and SR motors.
4. Test induction motor by megger and Motor Checker.
5. Perform dismantling and re-assembling the electromagnetic AC contactors of different voltages, types, makes and categories.
6. Set different types of motor protection relays.
7. Identify terminals of alternator, connecting, starting, running, loading and plotting characteristic curves.
8. Start synchronous motors by different methods.
9. Check Programming on Microprocessor/Microcontroller.
10. Identify different parts of a personal computer.
11. Identify different types of power electronics components.
12. Identify different firing circuits of thyristors (RC, UJT, Ramp and cosine firing circuits).
13. Use single phase and three phase converter- half wave, full wave, half controlled etc.
14. Check power MOSFET, thyristors, IGBT, GTO, IGCT, IGBT, power diode etc.
15. Identify a real time microprocessor based AC drive used in different processes in industries & carry out maintenance and troubleshooting of AC drive.
16. Verify working principal and characteristic of different sensors and transducers viz. LVDT, strain gauge, capacitive gauge, thermocouples, RTDs thermistors etc.
17. Configure smart transmitter using HART and other configurations & operate a controller, setting of its PID values, controller tuning.

**Block – II**

18. Identify different I/O modules of PLC, develop simple programmes involving bit level instructions, timers and counters, simple data manipulation instruction, feeding and running the programmes in PLC, I/O forcing.
19. Identify hardware of DCS, process operation using DCS.
20. Identify different components such as reservoir, fitter, pumps, float switch, valves, actuators etc. & Operate proportional and servo valves, functions of control and feedback components.

21. Identify simple hydraulic & pneumatic devices and circuits, reading and interpretation
22. Fabricate electronic circuits on assembly and test power supply with filter and regulators on PCB by soldering the components.
23. Perform soldering and de-soldering SMDs/ICs, test different types of sensors, transducer and switches.
24. Perform testing and maintenance of electronic modules such as rectifiers, amplifiers, oscillators, logic circuits, multivibrator, multiplexer, timers, voltage regulators, ADC, DAC etc.
25. Repair defective electronics equipment such as power suppliers, microprocessor based circuits, weighing system, PA system, communication equipment including fiber optic communication modules.
26. Identify various types of power transmission equipment/ devices- Conductors, support, insulators and cables.
27. Check connection of relays, maintenance and adjustment of arc chute and contact.
28. Check Emission and pollution control equipment, dust handling & disposal system, effluent treatment plants, emission monitoring equipment.
29. Carry-out repair/ test/ calibration of instruments/equipment/ maintenance job under the guidance of competent person, work with skilled supervisors/ workmen/ operators & prepare report on the job done.

**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

| **ELECTRONIC MECHANIC (STEEL PLANT)** | | | |
|---|---|---|---|
| **LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20Apprentices)** | | | |
| **A. TRAINEES TOOL KIT** | | | |
| **Sl. no.** | **Name of the Tool &Equipments** | **Specification** | **Quantity** |
| 1. | Connecting screwdriver | 100 mm | Quantity to be sufficient as per seats surveyed & allocated |
| 2. | Neon tester | 500 v | |
| 3. | Screwdriver set (set of 5 bits) - plane and diamond ended | | |
| 4. | Insulated combination pliers | 150 mm | |
| 5. | Insulated side cutting pliers | 150 mm | |
| 6. | Long nose pliers | 150mm | |
| 7. | Soldering iron | 25 w, 240 v | |
| 8. | Electrician knife D.B | | |
| 9. | Digital multimeter portable | | |
| 10. | Soldering iron | 15 W/25 W/ 65 W | |
| 11. | Desoldering pumps | | |
| **B : List of equipments required** | | | |
| 12. | First aid kit | | Quantity to be seats surveyed & allocated |
| 13. | Fire extinguisher | | |
| 14. | Bench vice | | |
| 15. | Steel rule | | |
| 16. | Digital multimeter | | |
| 17. | 30-0-30 V, 2A D.C regulated power supply | | |
| 18. | 0-300V, 500mA DC regulated power supply | | |
| 19. | LCR bridge( digital) | | |
| 20. | Signal generator | 100 kHz | |
| 21. | Digital storage oscilloscope, | 100MHz with probe | |
| 22. | Wattmeter | | |
| 23. | Megger (insulation tester) | | |
| 24. | Megger (earth testing) | | |
| 25. | Battery charger | | |
| 26. | Digital IC tester | | |
| 27. | Pulse generator | | |
| 28. | Logic probes | | |
| 29. | DOL starter | | |

| | | | |
|---|---|---|---|
| 30. | DOL starter with forward/reverse control | | |
| 31. | Automatic sequencing control | | |
| 32. | Overload relays (Thermal, magnetic, electronic) | | |
| 33. | On delay timer, off delay timer | | |
| 34. | Earth leakage circuit breaker | | |
| 35. | Dimmer stat, 8 Amps | | |
| 36. | Counters | | |
| 37. | Temp. controller | | |
| 38. | DC motor control training kit (Electronic) | | |
| 39. | Level detector | | |
| 40. | Output power meter | | |
| 41. | Distortion factor meter | | |
| 42. | EPROM programmer | | |
| 43. | Microprocessor trainer kit along with ADC/DAC with stepper | | |
| 44. | motor controller | | |
| 45. | Proximity switches | | |
| 46. | Photo tachometer | | |
| 47. | Burglar alarm | | |
| 48. | Smoke detector | | |
| 49. | Emergency tube light | | |
| 50. | Single phase preventer | | |
| 51. | Servomotor | | |
| 52. | Servo controller | | |
| 53. | Absolute encoder | | |
| 54. | Rotary encoder (incremental) | | |
| 55. | DC tong tester | | |
| 56. | Weighing system (load cell based) | | |
| 57. | Programmable logic controller(PLC) with programming unit | | |
| 58. | Personal computer with latest configuration with printer | | |
| 59. | High voltage testing kit | | |
| 60. | Surge generator | | |
| 61. | Instrument training kit (LVDT, Strain gauge, Thermocouple etc) | | |
| 62. | Electronic voltmeter | | |
| 63. | DC generator | | |
| 64. | DC motor | | |
| 65. | Single phase alternator | | |

| | | | |
|---|---|---|---|
| 66. | SMPS | | |
| 67. | Induction motor( single phase) | | |
| 68. | Stroboscope | | |
| 69. | Synchronous motor | | |
| 70. | Transformer | (1 ph/ 3 ph), 1 KVA | |
| 71. | Motorized control valve | | |
| 72. | Solenoid valve | | |
| 73. | Strain gauge | | |
| 74. | Load cell | | |
| 75. | LVDT | | |
| 76. | Dual trace CRO | 100 Mhz | |
| 77. | Analog IC trainer kit and Discrete component training kit | | |
| 78. | Linear amplifier trainer | | |
| 79. | Digital IC trainer kit | | |
| 80. | Magnifying glass for IC no. reading | | |
| 81. | Microprocessor 8085 /Microcontroller trainer kit | | |
| 82. | Digital trainer A/D ,D/A convertor, Mux, Demux, display devices, etc | | |
| 83. | Motor trainer with dummy loads | | |
| 84. | Three phase motor speed controller/ trainer kit | | |
| 85. | Soldering station | | |
| 86. | De-soldering station | | |
| 87. | Hot air soldering station- cum -de soldering station for SMD devices | | |
| 88. | PLC training kit | | |
| 89. | CNC training kit | | |
| 90. | 3 ph alternator | | |
| **C. List of consumable materials** | | | |
| 91. | Maintenance free batteries | | Quantity to be sufficient as per seats surveyed & allocated |
| 92. | Re-chargeable cells-dry cells | | |
| 93. | Power diodes | | |
| 94. | Heat sinks, heat sinks compounds | | |
| 95. | LED"s | | |
| 96. | Switches | | |
| 97. | Relays (AC/DC), contactors(AC/DC), | | |
| 98. | Push button switches | | |
| 99. | Lamps | | |
| 100. | IC"s | such as - 7400,4001,4011,4017,4007, 4033,74159,74154,etc | |

| | | | |
|---|---|---|---|
| 101. | OPAMP IC 741 wave form generator IC 8035 | | |
| 102. | IC DAC 0808, IC ACD 0801 | | |
| 103. | Transistors , JFET, MOSFET, UJT | | |
| 104. | Various diodes | | |
| 105. | Various transistors | | |
| 106. | Microphone | | |
| 107. | Speaker | 4", 8 ohm | |
| 108. | Various capacitors | | |
| 109. | Various resistors | | |
| 110. | Various transformers | | |
| 111. | SCR,DIAC,TRIAC, GTO, IGBT, IGCT | | |
| 112. | 7-segment display (both common cathode and anode) | | |
| 113. | J & T type thermo couple | | |

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

**TRADE: Electronic Mechanic (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 IS: 1444 | (700mm x500 mm) | 20+1 set |
| **B : Furniture Required** | | | |
| 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 | Candidate Name | Father's/Mother's Name | Safety consciousness (15) | Workplace hygiene (5) | Attendance/ Punctuality (10) | Ability to follow Manuals/ Written instructions (5) | Application of Knowledge (10) | Skills to handle tools & equipment (10) | Economical use of materials (5) | Speed in doing work (10) | Quality in workmanship (15) | VIVA (15) | Total internal assessment Marks | Result (Y/N) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Maximum Marks (Total 100 Marks)** | | | **15** | **5** | **10** | **5** | **10** | **10** | **5** | **10** | **15** | **15** | | |
| **1** | | | | | | | | | | | | | | |
| **2** | | | | | | | | | | | | | | |