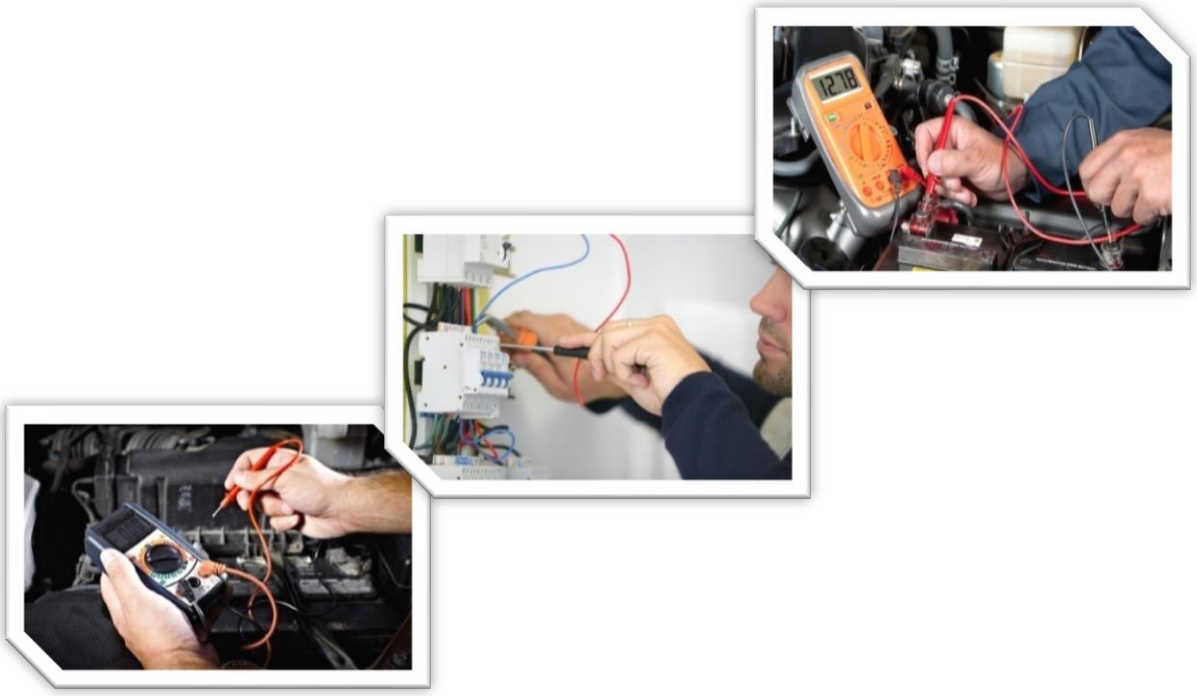
ELECTRICAL MECHANIC

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 5



SECTOR – POWER

सत्यमेव जयते

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

Directorate General of Training

Skill India
कौशल भारत-कुशल भारत

ELECTRICAL MECHANIC

(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
EN-81, Sector-V, Salt Lake City,
Kolkata – 700 091

ACKNOWLEDGEMENT

The DGT sincerely express appreciation for the contribution of the Industry, State Directorate, Trade Experts and all others who contributed in revising the curriculum.

Special acknowledgement is expended 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 Directorate General of Training (DGT) to develop skilled manpower for the industry**.** There are four categories of apprentices namely**; trade apprentice, graduate (engineers), technician and technician (vocational) apprentices.**

Entry 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 DGT and those successful in the trade tests are awarded the National Apprenticeship Certificate (NAC) by DGT having worldwide recognition.

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. It will ensure stronger collaboration between industry and the trainees which will augment supply of skilled workforce and enable 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 Directorate General of Training (DGT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of DGT for propagating vocational training.

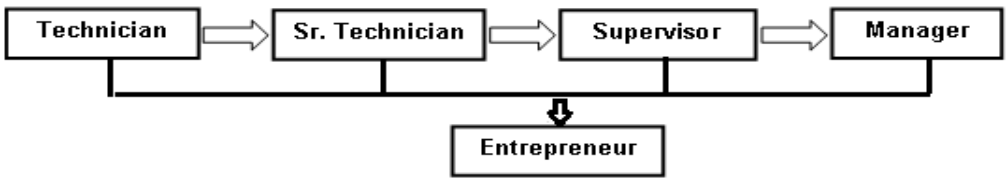
Electrical Mechanic trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while Core 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 DGT 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:

- On completion of the training the trainee will have an opportunity to move in vertical/horizontal pathways to promote to higher designations. The trainee can further undergo other specialized courses to excel in the relevant field:



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	**BT– I**	**-----**	**BT – II**	**------**
Practical Training (On - job training)	**----**	**OJT – I**	**------**	**OJT – II**

A. Basic Training

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

S No.	Course Element	Total Notional Training Hours (For 02 yrs. Course)
1	Professional Skill (Trade Practical)	550
2	Professional Knowledge (Trade Theory)	240
3	Workshop Calculation & Science	40
4	Engineering Drawing	60
5	Employability Skills	110
	Total (including Formative Assessment)	**1000**

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.

Total training hours:-

Duration	Basic Training	On-Job Training	Total
For 02 Engg. yrs. course	1000 hrs.	3120 hrs.	4120 hrs.

2.4 ASSESSMENT & CERTIFICATION:

The trainee will be tested for his/her 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.

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. The marks of formative 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 DGT 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 before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percentage is 40% for each Theory Examination (except for Employability Skill it is 34%) and 60% marks for each Trade practical Examination. The candidate should 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 formative assessments are to be preserved until forthcoming 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 • 60-70% 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% 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% 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:

Mechanic, Precision Instrument, Electrical; Meter Repairer, Electrical repairs and sets electrical parts of precision instruments such as megger, voltmeter, ammeter, condensers, galvanometers, etc. to high accuracy for recording correct readings by reviving, replacements and necessary adjustments. Studies drawings, circuit diagrams and other specifications and examines instrument visually to locate any apparent loose connection, short circuits etc. Dismantles instrument using insulated screw drivers, pliers, special spanners etc. and checks components, insulation wiring, fittings and other features with precision mechanical and electrical measuring instruments to locate wear and tear, short circuits and other defects. Cleans necessary or any fluid used in instrument and their various parts using special brushes. Checks gear shell, bearing jewels and other operating parts and repairs or replaces worn out and damaged ones. Assembles parts, replaces insulation and makes electrical wiring and connections according to diagram and prescribed specification. Examines assembled or repaired instrument by standard tests, makes necessary adjustments and ensures correct reading and desired performance within prescribed limits. Seals cut-outs, meters etc to avoid manipulation. May wind coils, set new resistance and perform other electrical functions, if required.

Electrical Technician; is also called 'Electrical Sub-System Integrator', the Electrical Technician integrates multiple PCBs and power supply and other electrical module into the product. The individual at work integrates together modules and sub parts that form the electronic system of the product.

Maintenance Technician Electrical; is responsible for providing assistance to the maintenance technicians in maintaining the Electrical/electronic systems of equipment and machinery.

Reference NCO-2015: -

i) 7412.0100 - Mechanic, Precision Instrument, Electrical
ii) 8212.2401 - Electrical Technician
iii) 3113.0102 - Maintenance Technician Electrical

4. NSQF LEVEL COMPLIANCE

NSQF level for Electrical Mechanic 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
e. Responsibility

The Broad Learning outcome of Electrical Mechanic 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	**Electrical Mechanic**
NCO-2015	7412.0100, 3113.0102, 8212.2401
Trade Code	DGT/3191
NSQF Level	Level – 5
Duration of Apprenticeship Training (Basic Training + On-Job Training)	Two years
Duration of Basic Training	a) BT–I : 3 months b) BT – II : 3 months **Total duration of Basic Training: 6 months**
Duration of On-Job Training	a) OJT–I: 9 months b) OJT–II : 9 months **Total duration of Practical Training: 18 months**
Entry Qualification	Passed 10th Class examination 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/ formative assessment will be held on completion of each year. Final examination for all subjects will be held at the end of course and same will be conducted by DGT.
Rebate to Ex-ITI Trainees	01 year
CTS trades eligible for Electrical Mechanic Apprenticeship	1. Broad Based Basic Training in Process Plant Maintenance Sector under Centre of Excellence Scheme and Advanced Module of Centre of Excellence Scheme in Electrical maintenance of Process Plant. 2. Electrician

Note:

- *Industry may impart training as per above time schedule for different OJT, 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 DGT.*

6. LEARNING OUTCOME

6.1 SPECIFIC LEARNING OUTCOME

The following are minimum broad Specific Learning Outcome after completion of the Electrical Mechanic course of 02 years duration under ATS:

1st Year:-

1. Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety.
2. Select & perform electrical measurement of single range meters & calibrate the instrument.
3. Test & service different batteries used in electrical applications & record the data to estimate repair cost.
4. Plan & execute soldering & de-soldering of various electrical components like switches, PCB & transformers for electrical circuits.
5. Identify & check different motor parts & application of AC & DC Motors.
6. Check application and operation of conveyer system, limit switch & Fitting.
7. Identify the terminals of sealed compressor and their wiring, measure current, volts, watts, use DOL starter with different types of motors and check application of DOL & Star Delta Starter.
8. Plan and prepare cable layout, crimp, terminate and fit electrical accessories, switch, and junction box used in different electrical industries.
9. Assemble simple electrical power supply circuits & test for functioning.
10. Carry out maintenance & fitting of Overload relay, earth leakage relay, CT & PT.
11. Assemble accessories & carry out industrial wiring of control cabinets & equipments.
12. Apply proxy switch, smoke detector, different light sensor detector, counter etc. & their fittings.
13. Identify modules of PLC, its function, Wire & connect the I/O field devices to the I/O Module of PLC and carry out maintenance of PLC Panel.

2nd Year:-

14. Construct different electrical control circuits and test for their proper functioning with due care & safety.
15. Plan & interface the LCD, LED, DPM panels to various circuits and evaluate performance.
16. Detect the faults & troubleshoot SMPS, UPS & their maintenance.
17. Plan & carryout maintenance of different welding machines' parts by selecting appropriate welding process.

18. Identify constructional feature, check the function & carryout maintenance of motorized valves.
19. Plan and prepare earthing installation and dedicated earthing system.
20. Detect the faults & troubleshoot electrical equipments.
21. Execute testing, evaluate performance & application of stepper motor.
22. Apply & handle different types of circuit breaker.
23. Plan & carryout installation, fault detection, repairing of Electrical drive of vibrator, crusher and maintenance of Dryers.

6.2 GENERIC LEARNING OUTCOME

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

YEAR 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, Mensuration, Trigonometry, Heat & Temperature, 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, Lines, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, 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.

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

SPECIFIC LEARNING OUTCOME	
LEARNING OUTCOMES	**ASSESSMENT CRITERIA**
1st Year 1. Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety. 2. Select & perform electrical measurement of single range meters & calibrate the instrument. 3. Test & service different batteries used in electrical applications & record the data to estimate repair cost. 4. Plan & execute soldering & de-soldering of various electrical components like switches, PCB & transformers for electrical circuits. 5. Identify & check different motor parts & application of AC & DC Motors. 6. Check application and operation of conveyer system, limit switch & Fitting. 7. Identify the terminals of sealed compressor and their wiring, measure current, volts, watts, use DOL starter with different types of motors and check application of DOL & Star Delta Starter. 8. Plan and prepare cable layout, crimp, terminate and fit electrical accessories, switch, and junction box used in different electrical industries. 9. Assemble simple electrical power supply circuits & test for functioning. 10. Carry out maintenance & fitting of Overload relay, earth leakage relay, CT & PT. 11. Assemble accessories & carry out industrial wiring of control cabinets & equipments. 12. Apply proxy switch, smoke detector, different light sensor detector, counter etc. & their fittings. 13. Identify modules of PLC, its function, Wire & connect the I/O field devices to	*Assessment Criteria for each specific learning outcome mentioned under **1st year & 2nd year** (section: 10) ensures 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 the 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 also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.*

the I/O Module of PLC and carry out maintenance of PLC Panel. **2nd Year** 14. Construct different electrical control circuits and test for their proper functioning with due care & safety. 15. Plan & interface the LCD, LED, DPM panels to various circuits and evaluate performance. 16. Detect the faults & troubleshoot SMPS, UPS & their maintenance. 17. Plan & carryout maintenance of different welding machines' parts by selecting appropriate welding process. 18. Identify constructional feature, check the function & carryout maintenance of motorized valves. 19. Plan and prepare earthing installation and dedicated earthing system. 20. Detect the faults & troubleshoot electrical equipments. 21. Execute testing, evaluate performance & application of stepper motor. 22. Apply & handle different types of circuit breaker. 23. Plan & carryout installation, fault detection, repairing of Electrical drive of vibrator, crusher and maintenance of Dryers.	

GENERIC LEARNING OUTCOME	
LEARNING OUTCOME	**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 and explain different mathematical calculation & science in the field of study including basic electrical.	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, friction.
	2.2 Measure dimensions as per drawing

	[Different mathematical calculation & science - Work, Power & Energy, Algebra, Mensuration, Trigonometry, Heat & Temperature, Power transmission, Pressure].	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, Lines, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, 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 callipers, 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	6.1 Explain the concept of energy conservation, global

conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	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.

8. SYLLABUS

BASIC TRAINING (BT - I) Duration: Three Months		
Week No.	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
1	Introduction to safety including fire equipments & their uses. Familiarize with Fitter's hand tools. Filling a flat surface of mild steel & cast iron. Check for flatness, straightness & squareness. Hand tools and their uses: Identify the different hand tools; Selection of proper tools for operation and precautions in operation; care & maintenance of trade tools. Practice safety precautions while working in fitting jobs. Workshop practice on filing and hack-sawing. Practice simple sheet metal works, fitting and drilling. Make an open box from metal sheet.	Manufacturing process in brief. Outline of various subjects to be covered. Introduction to hand tools & their safety. Environment factors& personal safety. Identification, specifications, uses and maintenance of commonly used hand tools. State the correct shape of files for filing different profiles. Riveting of tags and lugs, cutting and bending of sheet metals, chassis and cabinets.
2	Physical introduction to measuring instruments-Handling of Instruments-Exercise in the use of liner measuring instruments Such as steel rule of different ranges. Outside calipers, in side Calipers for measuring inside. Outside measurement, in side measurement, depth gauge. Measurement of flat rectangular objects, cylindrical objects. Hollow components, threaded components. Exercises on external & internal measurements using micrometers & Height gauges.	Introduction to metrology objectives of metrology-measurement-Principles-methods of measurements. Terminology used in metrology- accuracy-repeatability-resolution etc. SI units of measurements - physical quantities under SI system. Selection of measuring instruments, care, use & maintenance of measuring instruments-handling of precautions instruments-vernier caliper micrometer, high gauge, dial gauge (Plunger & bevel type) with stand (0.01mm resolution), checking squareness using combination set.
3	Simple blue print reading. Mark out according to simple to simple blue print. Hack sawing to dimension. Filing flat & square to size to an accuracy of +0.1 mm. Marking & punching of stepped & angular components & finishing of	Marking & punching tools. & their uses Hacksaw-types, specification & their uses. Classification & specification of files, shapes, sizes and grades. Bench vice constructional details.

	stepped & angular components & finishing the part to the required shape & size to an accuracy of+0.1mm. Exercise on angular measurement using combination set & vernier bevel protector. Center drilling, reaming, counter sinking, counter boring and tapping for various sizes of mild steel and tapping on various size of mild steel material. Fitting exercise-simple to complex (Involving drilling, tapping, reaming, counter boring & slide fitting).	Selection criteria of file. Vernier bevel protector-reading and use. Use of thread gauge and screw micro meter. Drilling machine-types-drilling operation - drill bits. Reamers-types care & maintenance. Taps & Dies-Description. Care & maintenance, Lubricants for tapping. Determination of drill size for tapping selection of spindle R.P.M. for drilling, tool holding and work holding and work holding device, types of fasteners. Standard size of size of threads. Taps application of adhesive metal. Shellac etc.
4	Identify the Phase, Neutral and Earth on power socket, use a tester to monitor AC power. Construct a test lamp and use it to check mains healthiness. Measure the voltage between phase and ground and rectify earthing. Identify and test different AC mains cables. Measure the gauge of the wire using SWG and outside micrometer. Refer table and find current carrying capacity of wires. Crimp the lugs to wire end. Measure AC and DC voltages using multi meter.	Basic terms such as electric charges, Potential difference, Voltage, Current, Resistance. Basics of AC & DC. Various terms such as +ve cycle, - ve cycle, Frequency, Time period, RMS, Peak, Instantaneous value. Single phase and Three phase supply. Terms like Line and Phase voltage/ currents. Classification of cables according to gauge (core size), number of conductors, material, insulation strength, flexibility etc. Different type of electrical cables and their Specifications. Types of wires & cables, standard wire gauge (SWG).
5	Identify the rated output voltage and Ah capacity of given battery. Measure the voltages of the given cells/battery using analog/ digital multimeter. Measure the specific gravity of the electrolyte using hydrometer. Test a battery and verify whether the battery is ready for use of needs recharging. Practice soldering on different electronic components, small transformer and lugs. Practice soldering on IC bases and PCBs. Practice de-soldering using pump and wick. Join the broken PCB track and test. Identify and	Cells & Batteries Construction, types of primary and secondary cells. Materials used, Specification of cells and batteries. Charging process, efficiency, life of cell/battery. Selection of cells / Batteries etc. Use of Hydrometer. Types of electrolytes used in cells and batteries. Series/ parallel connection of batteries and purpose of such connections. Different types of soldering guns, related to Temperature and wattages, types of tips. Solder materials and their grading. Use of flux and other materials. Selection of soldering gun for specific requirement.

	use SPST, SPDT, DPST, DPDT, tumbler, push button, toggle, piano switches used in electronic industries. Make a panel board using different types of switches for a given application.	Soldering and De-soldering stations and their specifications. Different switches, their specification and usage.
6	Identify parts and terminals of three phase/ different types of single phase AC motors. Connect, start, run and reverse direction of rotation of slip-ring motor through rotor resistance starter and determine performance characteristic. Measure slip and power factor to draw speed torque (slip/torque) characteristics. Test for continuity and insulation resistance of three phase induction motors. Install, connect and determine performance of single phase AC motors. Start, run and reverse the direction of rotation of single phase AC motors. Conduct performance analysis of DC series, shunt and compound motors. Dismantle and identify parts of three point and four point DC motor starters. Assemble, Service and repair three point and four point DC motor starters. Practice maintenance of carbon brushes, brush holders, Commutator and slip-rings.	Working principle of three phase induction motor. Squirrel Cage Induction motor, Slip-ring induction motor; construction, characteristics, Slip and Torque. Braking system of motor. Maintenance and repair. Working principle, different method of starting and running of various single phase AC motors. Industrial applications of different single phase AC motors. Characteristics, losses and efficiency. Principle and types of DC motor. Relation between applied voltage back e.m.f., armature voltage drop, speed and flux of DC motor. DC motor Starters, relation between torque, flux and armature current. Changing the direction of rotation. Characteristics, Losses & Efficiency of DC motors. Routine and maintenance.
7	Installation and testing micro and limit switches with the load. Verifying its Control valves. Control valves functions and components, types of control valves, based on valve flow characteristics-liner, equal percentage, quick opening valves, globe valves, cage valves, butterfly valves, ball valves, sliding gate valves, diaphragm valves, split body valves, capacitive, inductive type valve, proximity switch, IR switch, micro switch, limit switch, other control valves, control valve mechanical considerations, selecting control valves,	Conveyer system: safety Precautions, introduction/ Applicable equipment, Handling & Storage, installation/ Set Up, Operation of Belt Systems. General Repair & Maintenance. Proximity switch, IR switch, micro switch, limit switch. AC motors and their types. Advantages of AC motor over DC motor. Revolving field theory. Phase splitting theory. Capacitor method and inductor method used to split the single phase. Torque – starting torque and running torque. Split phase

	valve positioner. Make an internal connection of automatic star-delta starter with three contactors. Connect, start and run three phase induction motors by using DOL, star delta and auto-transformer starters. Connect, start, run and reverse direction of rotation of slip-ring motor through rotor resistance starter and determine performance characteristic. Prepare terminations of cable ends; Practice on skinning, twisting and crimping; Identify various types of cables viz. RF coaxial feeder, screened cable, ribbon cable, RCA connector cable, digital optical audio, video cable, RJ45, RJ11, Ethernet cable, fiber optic cable splicing, fiber optic cable mechanical splices, insulation, gauge, current capacity, flexibility etc. used in various electronics products, different input output sockets; Identify suitable connectors, solder/crimp /terminate & test the cable sets.	induction motors, working principle and construction. Starter and its necessity.DOL starter and the safety devices incorporated in it. Description of hermetic compressor motor. Fundamentals of electricity, definitions, units & effects of electric current. Conductors and insulators. Conducting materials and their comparison. Different types of connector & their terminations to the cables. Male / Female type DB connectors. Ethernet 10 Base cross over cables and pin out assignments, UTP and STP, SCTP, TPC, coaxial, types of fibre optical Cables and Cable trays. Different types of connectors Servo 0.1" connectors, FTP, RCA, BNC, HDMI Audio/video connectors like XLR, RCA (phono), 6.3 mm PHONO, 3.5 / 2.5 mm PHONO, BANTAM, SPEAKON, DIN, mini DIN, RF connectors, USB, Fire wire, SATA Connectors, VGA, DVI connectors, MIDI and RJ45,RJ11 etc.
8-9	**Power Supply Circuits** Identify different types of diodes, diode modules and their specifications. Test the diode using multi meter and determine forward to reverse resistance ratio. Measure the voltage and current through a diode in a circuit and verify its forward characteristic. Identify different types of transformers and test. Identify the primary and secondary transformer windings and test the polarity. Construct and test a half wave, full wave and Bridge rectifier circuit. Measure ripple voltage, ripple frequency and ripple factor of rectifiers for different load and filter capacitors. Identify and test Zener diode. Construct and test Zener based voltage regulator	Semiconductor materials, components, number coding for different electronic components such as Diodes and Zeners etc. PN Junction, Forward and Reverse biasing of diodes. Interpretation of diode specifications. Forward current and Reverse voltage. Packing styles of diodes. Different diodes, Rectifier configurations, their efficiencies, Filter components and their role in reducing ripple. Working principles of Zener diode, varactor diode, their specifications and applications. Working principle of a Transformer, construction, Specifications and types of

	circuit. Calculate the percentage regulation of regulated power supply.	cores used. Step-up, Step down and isolation transformers with applications. Losses in Transformers. Phase angle, phase relations, active and reactive power, power factor and its importance.
10	Measure the coil winding resistance of the given motor; Prepare the setup of DOL starter and Control an induction motor; Construct a direction control circuit to change direction of an induction motor; Connect an overload relay and test for its proper functioning; Verify terminals, identify components and calculate transformation ratio of single phase transformers; Perform OC and SC test to determine and efficiency of single phase transformer; Determine voltage regulation of single phase transformer at different loads and power factors; Perform series and parallel operation of two single phase transformers. Design layout of control cabinet, assemble control elements and wiring accessories for: Local and remote control of induction motor, Forward and reverse operation of induction motor; Automatic star-delta starter with change of direction of rotation. Sequential control of three motors; Carry out wiring of control cabinet as per wiring diagram, bunching of XLPE cables, channeling, tying and checking etc. Mount various control elements e.g. circuit breakers, relays, contactors and timers etc. Identify and install required measuring instruments and sensors in control panel. Test the control panel for its performance. Identification of various parts of relay	Fundamentals of single phase Induction motors, synchronous speed, slip, rotor frequency. Torque-speed characteristics, Starters used for Induction motors. Maintenance & fitting of overload relay. Working principle, construction and classification of transformer. Single phase and three phase transformers. Turn ratio and e.m.f. equation. Series and parallel operation of transformer. Voltage Regulation and efficiency. Auto Transformer and instrument transformers (CT & PT). Study and understand Layout drawing of control cabinet, power and control circuits. Various control elements: Isolators, pushbuttons, switches, indicators, MCB, fuses, relays, timers and limit switches etc. Wiring accessories: Race ways/ cable channel, DIN rail, terminal connectors, thimbles, lugs, ferrules, cable binding strap, buttons, cable ties, sleeves, grommet and clips etc. Testing of various control elements and circuits Types of relays and its operation. Types of circuit breakers, their applications and functioning. Production of arc and quenching.

	and ascertain the operation, Practice setting of pick up current and time setting multiplier for relay–operation. Identify the parts of circuit breaker, check its operation. Test tripping characteristic of circuit breaker for over current and short circuit current. Practice on repair and maintenance of circuit breaker.	
11	Construct and test a zero crossing detector. Make simple projects/ Applications using ICs 741, 723, 555, 7106, 7107 Sample projects: Smoke detector; Construct and operate conductivity probe Level indicator; Construction and operation of capacitance probes indicating transmitters and sonic level detector; Install and test capacitance probes indicating transmitters and sonic level detector; Service and calibrate capacitance probes indicating transmitters and sonic level detector; Indentify and carry out maintenance & preventive maintenance of above level indicators and transmitters. Construct and test a four bit asynchronous binary counter using 7493 and 7493 as a modulus-12 counter. Introduction to the trade area & the type of jobs made by the trainees in the workshop. Safety on handling tools & equipment related to the trade. Setting up of arc & gas apparatus. Lighting & adjustment of oxyacetylene flame & fusion runs with & without filter rode on 2 to 3 mm thick M S sheet (in flat position in gas). Striking & maintaining of arc & drawing shot heads of M.S. _plate 10 to 12 mm thick (in flat position in arc).	Zero cross detector, differentiator, integrator and instrumentation amplifier, other popular Op-Amps. Discussion on the identified projects with respect to data of the concerned ICs. Components used in the project; Smoke Detector Sensors. Electrical method conductivity and capacitance method for. Measuring the liquid level, capacitance probes, zero and span adjustments, sonic level detectors, point level detection. Different types of light sensor detector; their fittings. Basics of Counters, types, two bit and three bit Asynchronous binary counters and decade counters with the timing diagrams. Introduction to welding trade, importance of welding in industrial development. Subject to be taught & achievement of be made. Safety precautions in gas & electric, welding, elementary knowledge of first aid. Description & uses of welding tools & equipments, Method of shaping & jointing of metals, riveting, bolting, brazing, soldering & welding.

12	Identify each module in a rack and mount in the specified slot; Wire and connect the digital I/OS field devices to the I/O Module of PLC. Install PLC Programming software and establish communication with PC and PLC. Hardware configuration and Prepare the input and output addresses for each slot. Prepare and download ladder programs for various switching Gates.	Introduction to programmable controllers. History of programmable controllers, general characteristics of programmable controllers, some limitation of PLCs, method of developing PLC programming.
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 (BT – II) Duration: (03) Three Months		
Week No.	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
1-2	Identify different types of fuses along with fuse holders, overload (no volt coil), current adjust (Biometric strips to set the current). Test the given MCBs. Connect an ELCB and test the leakage of an electrical motor control circuit. Measure the coil winding resistance of the given motor. Prepare the setup of DOL starter and Control an induction motor. Construct a direction control circuit to change direction of an induction motor. Connect an overload relay and test for its proper functioning.	Necessity of fuse, fuse ratings, Different types of fuses, fuses bases. Single/ three phase MCBs, single phase ELCBs. Types of contactors, relays and working voltages. Contact currents, protection to contactors and high current applications. Fundamentals of single phase Induction motors, synchronous speed, slip, rotor frequency. Torque-speed characteristics, Starters used for Induction motors.
3-4	Identify LED Display module and its decoder/driver ICs. Display a word on a two line LED. Measure/current flowing through a resistor and display it on LED Module. Measure/current flowing through a sensor and display it on a LED module (DPM). Identify LCD Display module and its decoder/driver ICs. Measure/current flowing through a resistor and display it.	Different types of seven segment displays, decoders and driver ICs. Concept of multiplexing and its advantages. Block diagrams of 7106 and 7107and their configuration for different measurements. Use of DPM with seven segment display. Principles of working of LCD. Different sizes of LCDs. Decoder/ driver ICs used with LCDs and their pin diagrams. Use of DPM with LCD to display different voltage & current signals.
5-6	**AC & Refrigerator:** Identifying various components, electrical circuits, testing components, fault detection. Identify the components/devices and draw their corresponding symbols. Dismantle the given stabilizer and find	**AC & Refrigerator:** Construction and working principle, types, trouble shooting & care and maintenance. Concept and block diagram of manual, automatic and servo voltage stabilizer, o/p voltage adjustment.

	major sections/ ICs components. List the defect and symptom in the faulty SMPS. Measure / Monitor major test points of computer SMPS. Troubleshoot the fault in the given SMPS unit. Rectify the defect and verify the output with load. Record your procedure followed for trouble shooting the defects. Use SMPS used in TVs and PCs for Practice. Install and test the SMPS in PC. Install and test a inverter. Troubleshoot the fault in the given inverter unit. Rectify the defects and verify the output with load. Construct and test IC Based DC-DC converter for different voltages. Construct and test a Switching step down regulator using LM2576. Construct and test a switching step up regulator using MC 34063.	Voltage cut-off systems, relays used in stabilizer. Block Diagram of different types of Switch mode power supplies and their working principles. Various types of chopper circuits. Inverter; principle of operation, block diagram, power rating, change over period. Installation of inverters, protection circuits used in inverters. Battery level, overload, overcharging etc. Various faults and its rectification in inverter. Block diagram of DC-DC converters and their working principles.
7	Test electrical fault, diagnosis and remedial measure in AC & Refrigerator**.** Types, application & use of Gas welding, setting up of flames. Lighting & adjustment of oxyacetylene flame & fusion runs with & without filler rod on 2 to 3 mm thick M.S. sheet Lap & T Fillet joints on MS sheet 3 mm is flat position (gas). Brazing on MS & Copper.	Construction and working principle, types, troubleshooting. Description of electrical components used in AC & Refrigerator. Gas welding process. Gas flame combination their flame temp. & application. System of oxy-acetylene welding brief description of gas cylinders, regulators & blow pipes. Chemistry of neutral flame, Principle of acetylene cutting, object of using fluxes & rods. Different Welding Machines, their operation methods & maintenance.
8	Study & type of semi rotary, centrifugal & screw type compressor, Study, testing & servicing of air cooled condensers, evaporators, expansion valves & pressure switch.	Semi rotary, centrifugal & screw type compressor their types, construction, application & function. Condensers, evaporators, expansion valves, motorized valves& pressure switch their types, construction, application, function & maintenance. Automatic, thermostatic & capillary control. High pressure low pressure & oil failure switch their types, construction, application & function.
9	Servicing motor, blowers and fans used in	Description of blowers& fans, function

	different air conditioning systems Prepare pipe earthing and measure earth resistance by earth tester / megger; Prepare plate earthing and measure earth resistance by earth tester / megger; Test earth leakage by ELCB and relay. Plan work in compliance with standard safety norms related with earthing installation. Install the pipe earthing and test it. Install the plate earthing and test it. Measure the earth electrode resistance using earth tester. Perform earth resistance improvement.	and types, static and velocity pressure measurements. Importance of Earthing. Plate earthing and pipe earthing methods and IEE regulations. Earth resistance and earth leakage circuit breaker, earth leakage relay. Earthing Installation procedure; Testing methods; Measurement of earth resistance movement.
10	Identify Stepper motor parts, perform testing & operations of stepper motor. Explain its application. Construct a simple circuit to control stepper motor. Connect stepper motor with drive & control its parameters. Connect the stepper motor to computer for monitoring & controlling of various parameters. Parameter programming of stepper motor. Various control method for controlling velocity & torque.	Stepper mechanism, stepper motor principal, Difference between motors & stepper motor. Types of stepper motor, AC & DC - brushless stepper motor & permanent magnet stepper motor construction & application. Control method for stepper motor. Study of stepper drive.
11	Identify various parts of relay and ascertain the operation, Practice setting of pick up current and time setting multiplier for relay operation. Identify the parts of circuit breaker, check its operation. Test tripping characteristic of circuit breaker for over current and short circuit current. Practice on repair and maintenance of circuit breaker.	Types of relays and its operation. Types of circuit breakers, their applications and functioning. Production of arc and quenching.
12	Generate and demonstrate wave shapes for voltage and current of rectifier, single stage amplifier and oscillator using CRO. Demonstrate installation & testing process of Vibrator, Crusher. Carryout repair work of the Replace drier and capillary tube at the time of gas charging according to	Working Principle, types and applications of various vibrators & multivibrators. Functions of different parts of Vibrator motor, Crusher. Installation of Vibrator Motor, Crusher; Testing & Repair work. Vibrator Motor Repairs Features.

	manufacturer's direction. Identify drier and capillary tube used in different cooling machines.	Drier, Functions of drier, types, application and its advantage. Description of desiccants.
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

BT – I		
S No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	**Units & Measurements;** 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
2.	**Fractions**: Fractions, Decimal fraction, Addition, Subtraction, Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Calculator.	**Drawing Instruments : their 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.
3.	**Properties of Material** : 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 Alloys.	**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
4.	**Average:** Problems of Average. **Ratio & Proportion**: Simple calculation on related problems. **Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density.	**Drawing of Geometrical Figures:** Drawing practice on: - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.
		Dimensioning: - Definition, types and methods of dimensioning (functional, non-functional and auxiliary) - Types of arrowhead - Leader Line with text

		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.
5.	**Percentage**: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	**Method of presentation of Engineering Drawing** - Pictorial View - Orthogonal View - Isometric view
6.	**Forces definition.** - Definition and example of compressive, tensile, shear forces, axial and tangential forces. Stress, strain, ultimate strength, factor of safety for MS. Speed and Velocity: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation.	**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
7.	**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle. Volume of solids – cube, cuboids, cylinder and Sphere. Surface area of solids – cube, cuboids, cylinder and Sphere. - Area of cut-out regular surfaces: circle and segment and sector of circle. - Volume of cut-out solids: hollow cylinders, frustum of cone, block section. - Volume of simple solid blocks.	**Dimensioning practice:** - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance.
8.	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables). Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force.	**Construction of Geometrical Drawing Figures:** - Polygons and their values of included angles. - Conic Sections (Ellipse)
9.	**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power, mechanical efficiency, energy,	**Projections:** - Concept of axes plane and quadrant. - Orthographic projections

	use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	- Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification. Drawing of Orthographic projection from isometric/3D view of blocks

BT – II		
S No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	**Trigonometry:** Trigonometric ratios, Trigonometric tables. - Finding the value of unknown sides and angles of a triangle by Trigonometrical method. - Finding height and distance by trigonometry. **Friction** and its application in Workshop practice.	Machined components; concept of fillet & chamfer; surface finish symbols.
2.	**Heat & Temperature**: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	- Screw thread, their standard forms as per BIS, external and internal thread, conventions on the features for drawing as per BIS.
3.	**Basic Electricity**: Introduction, use of electricity, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthing.	Reading & interpretation of assembly drawing and detailing.
4.	**Transmission of power:** By belt, pulleys & gear drive.	Reading of drawing. Simple exercises related to missing lines, dimensions and views. How to make queries.
5.	**Concept of pressure** – units of pressure, atmospheric pressure, gauge pressure – gauges used for measuring pressure. **Introduction to pneumatics & hydraulics systems.** Solution of DGT test papers	- Simple exercises related to trade related symbols. - Solution of DGT test papers.

9.2 EMPLOYABILITY SKILLS (DURATION: - 110 Hrs.)

BT – I **(Duration – 55 hrs.)**	
1. English Literacy	Duration : 20 Hrs. Marks : 09
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
Functional Grammar	Transformation of sentences, Voice change, Change of tense, Spellings.
Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking / Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. I.T. Literacy	Duration : 20 Hrs. Marks : 09
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
Computer Operating System	Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.
Word processing and Worksheet	Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.

Computer Networking and Internet	Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.
3. Communication Skills	Duration : 15 Hrs. Marks : 07
Introduction to Communication Skills	Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.
Motivational Training	Characteristics Essential to Achieving Success. The Power of Positive Attitude. Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning.
Facing Interviews	Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview.
Behavioral Skills	Problem Solving Confidence Building Attitude
BT – II (Duration – 55 hrs.)	
4. Entrepreneurship Skills	Duration : 15 Hrs. Marks : 06
Concept of	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue

Entrepreneurship	Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.	
Project Preparation & Marketing analysis	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.	
Institutions Support	Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.	
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.	
5. Productivity		Duration : 10 Hrs. Marks : 05
Benefits	Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.	
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation - How improves or slows down.	
Comparison with developed countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.	
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
6. Occupational Safety, Health and Environment Education		Duration : 15 Hrs. Marks : 06
Safety & Health	Introduction to Occupational Safety and Health importance of safety and health at workplace.	
Occupational Hazards	Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.	
Accident & safety	Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.	

First Aid	Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person.
Basic Provisions	Idea of basic provision legislation of India. safety, health, welfare under legislative of India.
Ecosystem	Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.
Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of Energy, re-use and recycle.
Global warming	Global warming, climate change and Ozone layer depletion.
Ground Water	Hydrological cycle, ground and surface water, Conservation and Harvesting of water.
Environment	Right attitude towards environment, Maintenance of in -house environment.
7. Labour Welfare Legislation	Duration : 05 Hrs. Marks : 03
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.
8. Quality Tools	Duration : 10 Hrs. Marks : 05
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of House-keeping, Practice of good Housekeeping.
Quality Tools	Basic quality tools with a few examples.

10. DETAILS OF COMPETENCIES (ON-JOB TRAINING)

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

OJT – I

1. Perform basic workshop operations using suitable tools for fitting, riveting, drilling etc. observing suitable care & safety.
2. Select & perform electrical measurement of single range meters & calibrate the instrument.
3. Test & service different batteries used in electrical applications & record the data to estimate repair cost.
4. Plan & execute soldering & de-soldering of various electrical components like switches, PCB & transformers for electrical circuits.
5. Identify & check different motor parts & application of AC & DC Motors.
6. Check Application and operation of conveyer system, limit switch & Fitting.
7. Identify the terminals of sealed compressor and their wiring, measure current, volts, watts, use DOL starter with different types of motors and check application of DOL & Star Delta Starter.
8. Plan and prepare cable layout, crimp, terminate and fit electrical accessories, switch, and junction box used in different electrical industries.
9. Assemble simple electrical power supply circuits & test for functioning.
10. Carry out maintenance & fitting of Overload relay, earth leakage relay, CT & PT.
11. Assemble accessories & carry out industrial wiring of control cabinets & equipments.
12. Apply proxy switch, smoke detector, different light sensor detector, counter etc. & their fittings.
13. Identify modules of PLC, its function, Wire & connect the I/O field devices to the I/O Module of PLC and carry out maintenance of PLC Panel.

OJT – II

14. Construct different electrical control circuits and test for their proper functioning with due care & safety.
15. Plan & interface the LCD, LED, DPM panels to various circuits and evaluate performance.
16. Detect the faults & troubleshoot SMPS, UPS & their maintenance.
17. Plan & carryout maintenance of different welding machines' parts by selecting appropriate welding process.
18. Identify constructional feature, check the function & carryout maintenance of motorized valves.
19. Plan and prepare earthing installation and dedicated earthing system.

20. Detect the faults & troubleshoot electrical equipments.
21. Execute testing, evaluate performance & application of stepper motor.
22. Apply & handle different types of circuit breaker.
23. Plan & carryout installation, fault detection, repairing of Electrical drive of vibrator, crusher and maintenance of Dryers.

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

ELECTRICAL MECHANIC			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 16 Apprentices)			
Sl. No.	**Name of the Tool & Equipment**	**Specification**	**Quantity**
LIST OF TOOLS & EQUIPMENT OF BASIC FITTING			
1.	Steel rule	30 cm graduated both in English & metric units	17 Nos.
2.	Outside spring caliper	150 mm	17 Nos.
3.	In side spring caliper	150mm	17 Nos.
4.	Hermaphrodite caliper	150mm	17 Nos.
5.	Divider spring	150mm	17 Nos.
6.	Centre punch	100mm	17 Nos.
7.	Hammer Ball pein	0.5 kg	17 Nos.
8.	Combination pliers	150mm	17 Nos.
9.	File flat bastard	300mm	17 Nos.
10.	File flat llnd cut	250mm	17 Nos.
11.	Engineers screw driver		17 Nos.
12.	File flat smooth	200mm	17 Nos.
13.	Cold chisel flat	25x200mm	17 Nos.
14.	Granite surface plate	1000x 630 mm grade l	2 Nos.
15.	Metal stand table for surface plate	900x900x1200mm	2 Nos.
16.	Screw driver set (multi heads)		1 No.
17.	Scribing block universal	300mm	2 Nos.
18.	V block universal	300mm	2 Nos.
19.	Tri square	150mm	2 Nos.
20.	Out side spring caliper	200mm	2 Nos.
21.	Divider spring	200mm	2 Nos.
22.	Inside spring caliper	200mm	2 Nos.
23.	Straight edge steel	1mtr.	1 No.
24.	Straight edge steel	500mm	1 No.
25.	Steel tape	2 meters.	1 No.
26.	Sprit level		1 No.
27.	Hammer ball pein	800gms	3 Nos.
28.	Screw driver heavy duty	300mm	2 Nos.
29.	Hammer lead	1 kg	1 No.
30.	Combination set	300mm	2 Nos.
31.	Spindle blade screw driver	100mm	2 Nos.
32.	Dial gauge	o/ 50mm	4 Nos.

33.	Lever type dial gauge	o/50mm	2 Nos.
34.	Dial gauge stand		4 Nos.
35.	Screw pitch gauge set for metric pitches	(0,5-7mm)	2 Nos.
36.	Radius gauge set metric	1-6mm	1No.
37.	Allen hexagonal key set	2.5-12mm	2 Nos.
38.	Spanner double ended set (seven pcs.) in metric.		4 Nos.
39.	Adjustable spanner 300mm		2 Nos.
40.	Reduction sleeve MT as required		1No.
41.	Angle plate	size 200x100x200mm	2 Nos.
42.	Angle plat adjustable	250 x 150 x175mm	1No.
43.	Solid parallels in metric		6 Nos.
44.	Oil can pressure feed	500m	3 Nos.
45.	Oil stone	150x50x25mm	2 Nos.
46.	Twist drills	3-13mm(parallel shank)	2 Nos.
47.	Drill chuck	0-20mm with taper shank	1 No.
48.	Centre drill	A 1-5	2 Nos.
49.	C clamps	100mm	1 No.
50.	C clamps	200mm	1 No.
51.	Tap & die set in box metric		1 No.
52.	Drill HSS taper shank	10-20mm	1 No.
53.	File flat second cut	250mm	4 Nos.
54.	File flat smooth	200mm	4 Nos.
55.	File Half round second cut	250mm	4 Nos.
56.	File triangular smooth	200mm	4 Nos.
57.	Needle file set		1 No.
58.	File square second cut	250mm	4 Nos.
59.	Reamer set	6-13mm by 1 mm	1No.
60.	Hacksaw adjustable	300mm	8 Nos.
61.	Bench vice	150mm jaw	8 Nos.
62.	Magnifying glasses	75mm	2 Nos.
63.	Micrometer out side	0-25mm	4 Nos.
64.	Micrometer out side	25-50mm	2 Nos.
65.	Micrometer depth gauge	0-150mm	2 Nos.
66.	Direct reading vernier caliper	300mm	4 Nos.
67.	Vernier height gauge	250mm	1No.
68.	Digital vernier caliper	200mm	1No.
69.	Vernier bevel protector with least count of 5 minutes		1No.
70.	Feeler gauge	0.1 -10 mm	1No.
71.	Pillar type drilling machine	12mm cap with accessories	1No.
72.	Redial drill machine	120mm Motorized with	1No.

		tapping attachment	
73.	Pillar type drill machine	20 mm caps, with accessories	1 No.
74.	Two wheel pedestal grinder	300mm	1 No.
75.	Hand drill machine	10mm capacity	1 No.
76.	Sledge hammer	10mm pound	1 No.
77.	Welding torch with tips assorted		1 No.
78.	Anvil		1 No.
79.	Mallet	11b.	1 No.
80.	Number/alphabetic punch	100mm	1 No.
81.	Welding transformer	200A	1 No.
82.	Welding cable for above capacity in mt		50 Nos.
83.	Electrode holder		
84.	Chipping hammer		4 Nos.
85.	Screen helmet		4 Nos.
86.	Pressure Regulator Oxygen double stage		1 No.
87.	Leather gloves pair		4 Nos.
88.	Tongs holding	300mm	4 Nos.
89.	Pressure Regulator Acetylene double stage		1 No.
90.	Arc welding table		4 Nos.
91.	Lugs for cable		20 Nos.
92.	Rubber Hose pope for Oxy. & Ace. in mt		50 Nos.
93.	Cutting torch Oxy-acetylene with tips		2 Nos.
94.	Spark lighter		6 Nos.
95.	Arc welding Generator set	350A	1 No.
96.	Gas Trolley		1 No.
Furniture			
97.	Instructor table	1200x760x760mm	1 No.
98.	Instructor chair with arm		1 No.
99.	Steel stools	300x300x450mm	16 Nos.
100.	Work bench	3000x1500x760mm	4 Nos.
101.	Discuss table	3000x1200x760mm	1 No.
102.	Steel locker with eight compartments		4 Nos.
103.	Steel almirah	1980x900x450mm	4 Nos.
LIST OF TOOLS & EQUIPMENT OF BASIC TURNING & MACHINING			
104.	Steel rule 30 both English & Metric Units		17 Nos.
105.	File Flat	2"[a] Cut 250 mm	17 Nos.
106.	Screw Driver	12"	17 Nos.
107.	Outside caliper spring type	150mm	17 Nos.
108.	Inside caliper spring type	150mm	17 Nos.
109.	Odd leg caliper spring type	150mm	17 Nos.
110.	Divider spring type	150mm	17 Nos.

111.	Centre Punch	100mm	17 Nos.
112.	Safety Glasses		17 Nos.
113.	Hammer Ball Pein	0.5Kg.	17 Nos.
114.	Combination Plier	150mm	17 Nos.
115.	File Flat bastard	300mm	17 Nos.
116.	File Flat Smooth	200mm	17 Nos.
117.	Cutting Plier	200 mm	1No.
118.	Centre Drill	2, 3&4	4 Nos.
119.	Vernier Height gauge	300mm	1No.
120.	Surface plate	900x900x120mm with stand /table	1No.
121.	Scribing Block Universal	300mm	2 Nos.
122.	"V" Block	100/7-80-A	
123.	Try Square	150 mm	2 Nos.
124.	Sprit level	2V 250, 05 Metric	1No.
125.	Hammer B.P	800 grams with handle	2 Nos.
126.	Combination set	300 mm	1No.
127.	Screw Driver Heavy Duty	300mm with handle	
128.	Outside spring caliper	200mm	2 Nos.
129.	inside spring caliper	200 mm	2 Nos.
130.	Straight edge steel	500mm	1No.
131.	Steel Rule 60 cm graduate bottom English & Metric Units		2 Nos.
132.	Hammer lead	1 kg.	1No.
133.	Surface Plate	400x400 mm	1No.
134.	Hand Hack saw frame fixed	300mm	4 Nos.
135.	File square	2" Cut 250mm	4 Nos.
136.	Swivel Base Machine Vice	200mm	4 Nos.
137.	Bevel gauge	200mm	1No.
138.	Telescopic Gauge	13 to 300mm	1No.
139.	Hack saw frame adjustable	250-300mm	2 Nos.
140.	Micro Mater	50-75	
141.	Micro Meter depth gauge	0-200mm	1No.
142.	Vernier Caliper	300mm (with all)	1No.
143.	Vernier bevel protector with	150 mm blade	1No.
144.	Micro Meter	0-25mm	2 Nos.
145.	Micro Meter	25-50mm	1No.
146.	Dial Test Indicator with Magnetic gauge type .grade A with magnetic base		1No.
147.	Screw pitch Gauge for metric and English pitches		2 Nos.
148.	Vernier Gear Tooth Caliper		1No.

149.	Sine bar	200mm	1No.
150.	Centre gauge	60 0 55 0	1No.
151.	Slip Gauge set (normal set) Metric		1No.
152.	Flange Micro-Meter	0-25mm	1No.
153.	Limit Plug Gauge	5mm to 25mm by 2.5mm Range	1No.
154.	Shaping machine	450 mm stroke (Motorized; with all attachments	2 Nos.
155.	Double Column planer	1500x100x1000 mm (Motorized) with all attachments	1No.
156.	Slotter Machine	180 mm Stroke (Motorized) with all attachments	1No.
157.	Drilling Machine pillar	20mm capacity	1No.
158.	Spanner set	D/E G.P. series 97 pcs each)	2 Nos.
159.	Angle plate	200x100x200 mm	1No.
160.	Instructor table	1200x760x760mm	2 Nos.
161.	Instructor chair with arm		2 Nos.
162.	Steel stool	300x300x450mm	16 Nos.
163.	Discussion table	3000x1200x760mm	1No.
164.	Tools cabinet		2 Nos.
165.	Steel almirah	1980x900x450	4 Nos.
166.	Steel lockers	8 compartments	4 Nos.
167.	Steel rack	4 shelves	3 Nos.
168.	Book shelf		1No.
169.	Black board with stand		1No.
170.	Fire extinguisher		2 Nos.
171.	Fire bucket with stand		4 Nos.
LIST OF TOOLS & EQUIPMENT OF BASIC REFRIGERATION & AIR CONDITIONING			
172.	Flaring tool set, single type for tube	4.7 to 16 mm OD	17 Nos.
173.	Swaging tool, punch type, set of size, for tube	4.7 to 16mm OD	17 Nos.
174.	Bending spring external type, for cu tube OD 6.4 to 16 MM		17 Nos.
175.	Pipe cutter miniature for cu tube	3 to 16 mm Dia	17 Nos.
176.	Pinch off tool for cu tube	6 to 18 mm	17 Nos.
177.	Pinch off Plier for cu tube	6 to 19 mm	17 Nos.
178.	Ratchet spanner	6.4 mm sq. reversible	17 Nos.
179.	Valve key T handle	4.7 & 6.4 mm sq.	8 Nos.

180.	Pressure gauge, Dia.	63mm with recalibration set screw, o to 35 kg/sq cm	2 Nos.
181.	Compound gauge Dia.	63mm with recalibration set screw, pressure 15 kg/sq cm vacuum 76 mm	2 Nos.
182.	Gas leak detector for halogen gas electronic		17 Nos.
183.	Line tester	500v heavy duty	17 Nos.
184.	Punch hole for cutting gasket	4 7 to 16mm Dia	4 Nos.
185.	Scissor for gasket cutting	250 mm long	17 Nos.
186.	L-Allen key set	1.5 to 6.4 mm	2 Nos.
187.	T-Allen key set	5/32" & 1/8"	2 Nos.
188.	Screw driver plastic handle	6x150 mm	17 Nos.
189.	Screw driver plastic handle	10x250 mm	8 Nos.
190.	Insulated combination pliers	200 mm	17 Nos.
191.	Adjustable wrench	250mm	17 Nos.
192.	Engineers steel rule	300mm	17 Nos.
193.	Engineers try square	200mm	17 Nos.
194.	Chisel flat	25x150 mm	17 Nos.
195.	Divider spring joint	150 mm	17 Nos.
196.	Caliper outside spring joint	150 mm	17 Nos.
197.	Caliper in side spring joint	150 mm	17 Nos.
198.	Spanner set double ended	4.7 to 16mm	4 Nos.
199.	Ring spanner set	4.7 to 16 mm	4 Nos.
200.	Philip screw driver set		4 Nos.
201.	Oil cane Pressure type		4 Nos.
202.	Measuring tape	2m	4 Nos.
203.	Hammer ball pein	450gm with handle	17 Nos.
204.	Hammer plastic	300 gm	4 Nos.
205.	File flat double cut	200 mm	6 Nos.
206.	File half round double cut	200 mm	4 Nos.
207.	Caliper odd leg spring joint	150 mm	4 Nos.
208.	Centre punch	8x100 mm	17 Nos.
209.	Bench vice	100 mm jaw	8 Nos.
210.	Flaring tool set. double type for tube	4.7 to 16 mm OD.	1No.
211.	Swaging tool, screw type with adaptor, set of size, for tube	4.7 to 16 mm OD	1No.
212.	Pipe Bending tool set lever type with degree indicator for cu tube OD6.4 to16MM01		1No.
213.	Platform scale heavy duty 0 to 50 kg.		1No.
214.	Refrigerant cylinder	30kg	2 Nos.

215.	Vacuum pump, two stage, self contained With motor, portable, final vac. 0.1 micron with gas ballistic valve, splash reducing non return valve cap1/2 HP		1 No.
216.	Charging cylinder SS portable cc & mm scale compensation for vol. fluctuation		1 No.
217.	Charging manifold with valves & gauges		1 No.
218.	Dial thermometer remote control dial-	75MM, - 55 c to + 50 c	
219.	Electronic leak detector transistorized with visible and audible indicator		1 No.
220.	Vacuum thermocouple gauge	1-3000mic	1 No.
221.	Stop watch		1 No.
222.	Filler gauge	0.05 to 1.0mm	1 No.
223.	Instrument screw driver set		1 No.
224.	Flexible box spanner set	6.4 to 10 mm	1 No.
225.	Socket set reversible ratchet % sq. drive with extension	4.7 to 31.3 mm	1 No.
226.	Torque wrench	300mm 12.7sq. drive	1 No.
227.	Blow lamp cap.	1 lit.	2 Nos.
228.	Puller 3 leg with flexible arm	120mm	1 No.
229.	Puller 2 leg with flexible arm	300 mm	1 No.
230.	Spirit level metallic	200 mm	1 No.
231.	Snipper sheet metal straight nose	200mm	*2* Nos.
232.	File square double cut	150mm	2 Nos.
233.	V block with clamp	75 mm	2 Nos.
234.	Micrometer out side	0 to 25 mm	1 No.
235.	Vernier height gauge	250 mm	1 No.
236.	Tap set with matching drills	3 to 16 mm	1 No.
237.	Tap set with matching drills	1/4" to 5/8 " mm	1 No.
238.	Stock & die set	3 to 16 mm	1 No.
239.	Gas Cylinder trolley two wheel type		1 No.
240.	Pedestal grinder double ended wheel Dia	200mm & 3000rpm.	1 No.
241.	Air compressor two stage	for oil less dry air with rust proof tank assembly, heater & controls max pr. 10kg/cm2 cap 45 lit 1 HP motor	1 No.
242.	Refrigerator compression type	165 lit	1 No.
243.	No frost refrigerator compression type	165 lit	1 No.
244.	Deep freezer	165lit,-180C, 1/4HP	1 No.

245.	Water Cooler storage type		1 No.
246.	Air cooler	16" fan size ss body	1 No.
247.	Desert cooler	20" fan size	1 No.
248.	Window air conditioner cap-	3000k cal/hr	1 No.
249.	Split air conditioner cap-	2000k cal/hr	1 No.
250.	Fire extinguisher		2 Nos.
251.	Fire bucket on stand		4 Nos.
252.	Respiration chart		1 No.
253.	Reciprocating compressor with provision of capacity control etc for demonstration		1 No.
254.	Cold storage plant complete with all controls & accessory including cooling tower & water treatment plant cap	15000k cal/hr	1 No.
255.	Ice candy unit complete with ss tank, mould Box, thermo Cole insulated sun mica body. Agitator compressor, motor pipe fitting etc.3000k cal/hr		1 No.
256.	Air conditioning plant, direct & indirect, water Chiller complete with all controls including Humidity control etc. cap 15000k cal/h		1 No.
257.	Working model of vapor absorption system Or refrigeration cap 1500k cal/hr		1 No.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: ELECTRICAL MECHANIC

LIST OF TOOLS & EQUIPMENTS FOR – 16 APPRENTICES

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

2) Infrastructure:

S No.	Name of the items	Specification	Quantity
A : TRAINEES TOOL KIT			
1.	Draughtsman drawing instrument box		16+1 set
2.	Set square celluloid 45^o	(250 X 1.5 mm)	16+1 set
3.	Set square celluloid 30^o-60^o	(250 X 1.5 mm)	16+1 set
4.	Mini drafter		16+1 set
5.	Drawing board IS: 1444	(700mm x500 mm)	16+1 set
B : Furniture Required			
1	Drawing Board		16 Nos.
2	Models : Solid & cut section		as required
3	Drawing Table for trainees		as required
4	Stool for trainees		as required
5	Cupboard (big)		01 No.
6	White Board	(size: 8ft. x 4ft.)	01 No.
7	Trainer's Table		01 No.
8	Trainer's Chair		01 No.

TOOLS & EQUIPMENT FOR EMPLOYABILITY SKILLS		
S 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 FORMATIVE 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 :	**Examination:**		**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 formative assessment Marks**	**Result (Y/N)**
1														
2														