MECHANIC MAINTENANCE

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5

SECTOR – CAPITAL GOODS & MANUFACTURING

सत्यमेव जयते

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

Directorate General of Training

Skill India
कौशल भारत-कुशल भारत

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(Revised in 2018)

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Version 1.0

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

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

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Expert Group Designation
1.	Mr. Haritash Gulshan, Director	Training & Employment, Uttrakhand, Haldwani (Nainital)	chairman
2.	L.K. Mukherjee, Deputy Director	CSTARI, Kolkata	Member
3.	Mr. A. Rarhi, Deputy Director	CSTARI, Kolkata	Member
4.	Mr. Mayank Agrawal, Principal	Govt. I.T.T. (B), Kashipur	Member
5.	Mr. S.Devrajan, Asst. General Manager	India Glycols Ltd. Kashipur	Member
6.	Mr. J.Khuntia, Deputy General Manager	India Glycols Ltd. Kashipur	Member
7.	Mr.R.J.Singh, Workshop Supdt.	Govt. Polytechnic, Kashipur	Member
8.	Mr. P.C.Navani, Foreman	Govt. I.T.T. (B), Kashipur	Member
9.	Mr. Vinod Kumar, Engineer	Kashipur Sugar Mill, Kashipur	Member
10.	Mr. Rohan Pathak, Off. ERD	Mahindra & Mahindra Ltd., Lalpur	Member
11.	Mr. Ankur Agrawal, Deputy Manager	Mahindra & Mahindra Ltd., Lalpur	Member
12.	Mr. Himanshu Marwat, Manager (Elec.)	Naini Tissues Ltd. Kashipur	Member
13.	Mr. N.C.Pant, Sr. Manager	Naini Tissues Ltd. Kashipur	Member
14.	Mr. Vivek Varshney, GM (Maint)	Banwari Paper Mill, Kashipur	Member
15.	Mr. Anil Kumar In-charge Technician	Banwari Paper Mill, Kashipur	Member
16.	Mr. Romesh Sharma, Executive	Nestle India Ltd., Pantnagar	Member
17.	Mr. R.N. Pande, Divisional Manager	Tata Motors Ltd., Pantnagar	Member
18.	Mr. Praguman Verma, Asst. Manager	Tata Motors Ltd., Pantnagar	Member

19.	Mr. Raj Deep Sharma, Instructor	Govt. ITI (B), Kashipur	Member
20.	Mr. G.D. Sharma, Instructor	Govt. ITI (B), Kashipur	Member
21.	Mr. Anurodh Sharma, Executive	Dabur India Ltd., Pantnagar	Member
22.	Mr. S.K. Singh, GM	Alps Industries Ltd., Kashipur	Member
23.	Mr. S. Nagar, Manager (HR)	Pepsico India Holdings Pvt. Ltd.,	Member

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 by Director General of Training(DGT) to develop skilled manpower for the industry**.** There are four categories of apprentices namely**; trade apprentice, graduate (engineers), technician (diploma) 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) 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.Itwill 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 reforms 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 through various schemes.

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.

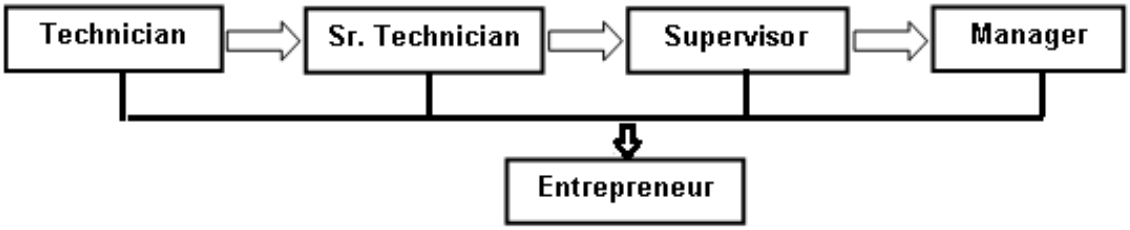
Mechanic Maintenance trade under ATS is delivered nationwide through different industries. The course is of two years duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, while Core area - Workshop Calculation 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 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/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	**BT– I**	**-----**	**BT – II**	**------**
Practical Training (On - job training)	**----**	**OJT – I**	**------**	**OJT – II**

A. Basic Training

For 02 yrs. Course (Engg) :-(**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 internal assessment)	**1000**

B. On-Job Training: -

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

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

C. Total training hours: -

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

2.4 ASSESSMENT & CERTIFICATION:

The trainee will be tested for his/her skills, 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 internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment. 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 teamwork, 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 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	• High skill levels in the use of hand tools, machine tools and workshop equipment • Above 80% accuracy achieved while undertaking different work with those

which demonstrates attainment of a high standard of craftsmanship.	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:

Maintenance Technician-Mechanical; is responsible for maintaining the mechanical systems of equipment and machinery. They use laid down procedures, and knowledge of the equipment to conduct routine maintenance and organize repairs. They are also involved in control and monitoring devices and occasionally in the manufacture of items that will help in maintenance.

Maintenance Fitter-Mechanical; dismantles, removes and replaces faulty equipment at component or unit level on a variety of different types of mechanical assemblies and sub-assemblies and diagnosing, locating faults, overhauling, fitting and adjusting mechanical systems and equipment.

Fitter General; sizes metal parts to close tolerances and fits and assembles them using hand tools for production or repairs of machines, or other metal products. Studies drawings to understand specification of different parts, fittings or assembles to be made and their functions. They select materials, appropriate tool and equipments to carry out their work. Holds the work in Vice, Cuts and shapes required parts to dimensions and specifications by processes of sawing, chipping, filing, grinding, drilling holes, screw cutting, scrapping etc., using hand tools for making specimens or finished components. Measures object while working using foot rules, callipers, micrometer, gauges etc. and checks for correct filing with square. Gets half-finished object marked or marks it himself using face plate, marking block scriber, vernier, height gauges, vee-blocks, angle plate, sine plate, slip gauges, combination set, etc. depending on accuracies required, to indicate guide lines for finished sizes, holes to be drilled and pitch centres, threads to be cut and other working details as specified in drawing or sample. Clamps object securely in correct position in vice and files it to required dimensions according to punch marks and guide lines frequently measuring it with callipers, micrometer, vernier, gauges etc, makes holes with drill, cuts threads with taps and dies ensuring that they are square or at required angle to base. Measures finished article with dial indicator, micrometer, vernier, height gauges, screw gauges, plug gauges, sine bar, slip gauge, etc according to prescribed accuracies. May make parts separately and assemble those with screws, rivets, pins, etc. as specified so as to make complete unit according to drawing. Dismantles or removes worn out, broken or defective parts using hand tools or power tools and replaces them by repaired or new ones. Performs repairing and maintenance work (including preventive maintenance) of simple machines, dismantles and replaces different components to construct circuit of Pneumatics and Hydraulics. Tests completed article/ assembly to ensure correct performance. May do simple turning of parts on machines and

perform welding, brazing, and like operations. May explain heat treatment processes viz., annealing, hardening, tempering etc. May specialize in particular type of machine or product and be designated accordingly. May suggest alterations.

Reference NCO-2015:

i) 3115.0102: Maintenance Technician Mechanical
ii) 7233.0100: Fitter General
iii) 7233.0101: Maintenance Fitter-Mechanical

4. NSQF LEVEL COMPLIANCE

NSQF level for Mechanic Maintenance 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 Mechanic Maintenance 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	**MECHANIC MAINTENANCE**
NCO - 2015	7233.0100, 7233.1100, 7127.0100
Trade Code	DGT/3194
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 under 10+2 system of education or its equivalent.
Selection of Apprenticeship	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 from time to time for the specific trade.
Infrastructure for Basic Training	As per related Trade of ITI
Examination	The internal examination/assessment will be held on completion of each 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	1 year
CTS trades eligible for Mechanic Maintenance Apprenticeship	Fitter, Maintenance Mechanic (Chemical Plant), Mechanic Refrigeration & Air Conditioner

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

6.1SPECIFIC LEARNING OUTCOME

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

1st Year:

1. Perform basic fitting operations that require well developed skills in industrial workshop practices and inspect dimensions with standard procedures.
2. Develop profiles as per drawing using standard procedure & tools to ensure appropriate accuracy.
3. Carry out marking of the components as per specification and standard procedure for Hacksawing, filing, drilling, riveting, fitting and allied operations in familiar context.
4. Execute preventive maintenance of lathe machine maintaining proper procedures and test for functionality by appropriate maintenance method.
5. Produce job observing proper procedures using various cutting tools involving different operations viz. Step turning, under cutting / Grooving, Knurling, Drilling, Reaming, Boring.
6. Check different electrical sub system & measure parameters. (Different Electrical sub system AC/DC motor, Alternator, dynamo etc.)
7. Dismantle, check and repair reciprocating compressor, its components and test efficiency of compressor.
8. Conduct electrical measurements using measuring instruments like ammeters, voltmeter and AC/DC meters.
9. Connect bare conductors using soldering method on printed boards.
10. Make simple circuits with a lamp and battery using multimeter, tong tester and megger.

2nd Year:

11. Carry out Preventive and Breakdown maintenance on Periodical and daily basis.
12. Check centrifugal pumps (Single & Multistage) with gland and mechanical seal and its accessories and reciprocating pumps, gear & pumps with its accessories by dismantling and assembling.
13. Dismantle and assemble reciprocating compressor - air refrigerant compressor and its accessories like receiver, chiller, evaporator, expansion valve & safety switches controls. Centrifugal compressor, skew, lobe type compressor etc.
14. Maintain & operate different types of valves - Ball, gate, glove, non-return valve, diaphragm & needle.
15. Carry out maintenance of refrigeration plant with its equipments and safety devices, air conditioning plant with its equipments and safety devices.

16. Dismantle and assemble different types of heat exchangers, gasket cutting choke removal, tube replacement.
17. Assemble and check pipelines having different types of joints like flange, screw, weld etc. & their fittings of accessories.
18. Fix and dismantle different types of bearings like ball, roller, needle, taper roller with the help of different types of attachments.
19. Overhaul and maintain different types of belts, chains, couplings and joints and chain pulley blocks, gearboxes.
20. Carry out NDT and thickness test.

6.1 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/Generic Learning Outcome after completion of the Mechanic Maintenance 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. *[Different mathematical calculation & science – Conversion of Units, Percentage,& Mensuration-Area & Volume of different surfaces and solids, and Properties of materials, Mass, weight, Density, Specific Gravity etc.]*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical figures like Triangles, Square, Rectangle, Rhombus, Parallelogram, Circle etc., Lettering & Numbering, Freehand sketching of Hand tools used for Mechanic Maintenance.*
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 fitting operations that require well developed skills in industrial workshop practices and inspect dimensions with standard procedures. 2. Develop profiles as per drawing using standard procedure & tools to ensure appropriate accuracy. 3. Carry out marking of the components as per specification and standard procedure for Hacksawing, filing, drilling, riveting, fitting and allied operations in familiar context. 4. Execute preventive maintenance of lathe machine maintaining proper procedures and test for functionality by appropriate maintenance method. 5. Produce job observing proper procedures using various cutting tools involving different operations viz. Step turning, under cutting / Grooving, Knurling, Drilling, Reaming, Boring. 6. Check different electrical sub system & measure parameters. (Different Electrical sub system AC/DC motor, Alternator, dynamo etc.) 7. Dismantle, check and repair reciprocating compressor, its components and test efficiency of compressor. 8. Conduct electrical measurements using measuring instruments like ammeters, voltmeter and AC/DC meters. 9. Connect bare conductors using soldering method on printed boards. 10. Make simple circuits with a lamp and battery using multimeter, tong tester and megger. **2nd Year** 11. Carry out Preventive and Breakdown maintenance on Periodical and daily basis. 12. Check centrifugal pumps (Single & Multistage) with gland and mechanical seal and its accessories and reciprocating pumps,	*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.*

gear & pumps with its accessories by dismantling and assembling. 13. Dismantle and assemble reciprocating compressor - air refrigerant compressor and its accessories like receiver, chiller, evaporator, expansion valve & safety switches controls. Centrifugal compressor, skew, lobe type compressor etc. 14. Maintain & operate different types of valves - Ball, gate, glove, non-return valve, diaphragm & needle. 15. Carry out maintenance of refrigeration plant with its equipments and safety devices, air conditioning plant with its equipments and safety devices. 16. Dismantle and assemble different types of heat exchangers, gasket cutting choke removal, tube replacement. 17. Assemble and check pipelines having different types of joints like flange, screw, weld etc. & their fittings of accessories. 18. Fix and dismantle different types of bearings like ball, roller, needle, taper roller with the help of different types of attachments. 19. Overhaul and maintain different types of belts, chains, couplings and joints and chain pulley blocks, gearboxes. 20. Carry out NDT and thickness test.	

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, apply in day to day	2.1 Explain concept of basic science related to the field such as Material science - Properties of materials, Ferrous & non-ferrous metals, etc.
	2.2 Mass, weight, Density, Specific Gravity etc.

work.*[Different mathematical calculation & science - Conversion of Units, Percentage, & Mensuration-Area & Volume of different surfaces and solids, and Properties of materials, Mass, weight , Density, Specific Gravity etc.]*	
	2.3 Use scale/ tapes to measure as per specification.
	2.4 Calculate area / volume of the materials.
	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.
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-. Geometrical figures like Triangles, Square, Rectangle, Rhombus, Parallelogram, Circle etc., Lettering & Numbering, Freehand sketching of Hand tools used for Mechanic Maintenance / Wireman / Electrician/ trade & wire joints, Signs & symbols for Electrical components used in electrical circuits and AC/DC systems, Electrical wiring diagram of different lamps, Schematic diagram of plate and pipe earthing, insulators used in overhead line, Layout diagram of a substation, Single line Diagram of Electrical substation feeders.]*	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.
	3.4 Read & interpret the signs and symbols for electrical components and AC/DC systems.
	3.5 Encounter drawings with electrical circuit diagrams and layout diagrams.
4. Select and ascertain measuring instrument and measure dimension of components and record data.	4.1 Select appropriate measuring instruments such as Ammeter, voltmeter, meggar, earth tester etc. (as per tool list).
	4.2 Ascertain the functionality & correctness of the instrument.
	4.3 Measure dimension of the components & record

	data to analyse the with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	5.1 Explain the concept of productivity and quality tools and apply during execution of job.
	5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.
	5.3 Knows benefits guaranteed under various acts.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.
	6.2 Dispose waste following standard procedure.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	7.1 Explain personnel finance and entrepreneurship.
	7.2 Explain role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
	7.3 Prepare Project report to become an entrepreneur for submission to financial institutions.
8. Plan and organize the work related to the occupation.	8.1 Use documents, drawings and recognize hazards in the work site.
	8.2 Plan workplace/ assembly location with due consideration to operational stipulation
	8.3 Communicate effectively with others and plan project tasks
	8.4 Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.

8. SYLLABUS

BASIC TRAINING (BT – I) **Duration: (03) Three Months**		
Week No.	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
1	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, inside Calipers& depth gauge.	Introduction to metrology objectives of metrology-measurement-Principles-methods of measurements.
2	Measurement of flat rectangular objects, cylindrical objects Hollow components, threaded components. Exercises on external & internal measurements using micrometers & Height gauges	Terminology used in metrology- accuracy-repeatability-resolution etc. SI units of measurements - physical quantities under SI system
3	Manufacturing process and their importance in Industries. Safety precautions followed on shop floor, Vernier caliper and micro-meter, construction, parts, principles, application making the jobs. Different types cutting tools, grinding practice on pedestal machine.	Outline of various subjects to be covered, disciplinary rules of the Institute training and other facilities available. Importance of measurement. Types of precision measuring tools, Micro-meter and Vernier caliper, Principle, Construction of various parts, reading of micrometer and Vernier caliper both English and Metric system.
4	Introduction of shaping, planning and slotting-construction, types, parts, function and uses, shaping rectangular block as per sketch.	Shaper, Planer and Slotting machine – construction, types, parts, and General principle of power transmission. Various cutting tools and their angles.
5	Use of refrigeration service tools, their care & safety. Cutting, bending And Joining of copper tubing, flaring, swaging, pinching & silver soldering. Identification of refrigeration system	Refrigeration service tools, types, specification & use, Refrigeration components, type & use. Refrigeration principal & its application. Vapor compression system, components & division-H.P. & L.P. sides of system. Refrigeration capacity of system.
6	Dismantling of Commercial type reciprocating compressor, Checking components & parts. Cutting gasket of compressor. Testing efficiency of compressor.	Refrigeration compressor- its function, mode of drive, type of compression classification. Reciprocating compressor name. Function, construction & parts.
7	Electrical measurement & measuring instruments, Testing and calibration of	Principle of M. C. & M. I. meters, measurement value, shunt constructions

	ammeters & volt meters of various types & construction of M. C. & M. I. Measurement of power by watt meter & calibration of watt meter, KWH meter.	& connection, voltage measurements, instrument sensitivity, meter accuracy, changing meter range. Using of AC/ DC meters.
8	Industrial Electronics: Identification of various types of diodes, LED' S & Seven segment displays. Hooking up a voltage regulator and determine its characteristics. Use of differential amplifier, operational amplifier. Identification of different of different types of oscillators.	Introduction to special semiconductors diodes & characteristics. Introduction & purpose shunt regulators, series regulators, I. C's regulators & switching regulators and study of operational integrator. Study of invertors & converters & special operational circuits. Study of different types of oscillators-crystal, phase shift Armstrong, colpitt's, clap, Hartley & I. C. oscillators.
9	Demonstration of use of safety equipments and artificial respiration. Use of hand tools, join practice with single and multi - stand conductors of different wires. Joining practice of bare conductors - soldering practice on printed circuit boards. Demonstration & practice on soldering the aluminum conductor and cable joints. Use of aluminum flux and Alca 'p' solder. Demonstration and practice of crimping of various wires.	Importance of safety - Description, specification, general care & maintenance of common hand tools, wires & cable - conductors, insulators & semiconductors- their shapes, sizes with respect to low, medium & high voltage. Soldering printed circuit boards &its uses- different fluxes for different purpose on metal's- crimping equipment- joining of conductors by soldering. Importance of preventive maintenance and routine tests. Earthing and its importance
10	Making of a simple circuit with a lamp and battery. Study and use of multi meters - measurement of current, voltage, resistance in DC\AC circuits. Demonstration & verification of ohm's law - series circuits - parallel circuits. Demonstration in circuits -use of tong tester and megger.	Resistance, voltage, current, open circuit and short circuits-ohm's law- voltage drop - series & parallel circuits-power & energy relations - electrical measuring instruments-millimeters common electrical accessories used in industries- bus-bars, replays, contactors, circuit breakers, etc. Fuses and its rating - materials used.
11	Safety precaution to be used in laboratory. Volumetric analysis- types of titration. Analysis of acids bases & salts.	Introduction to chemistry. Elements, atoms, molecule. Laws of chemical combination, chemical equilibrium, atomic, molecular & equivalent Weights, periodic table of elements. Study of different types of lab apparatus. Volumetric analysis
12	Young's modulus, law of parallelogram,	Periodic study of group elements.

	thermal conductivity of metals. Faraday's laws of electricity. Study of electric cells-series & parallel connections.	Metallurgy of- copper, iron, zinc, tin, lead, cobalt, Nickel& chromium.
13	**Assessment/Examination (03days)**	

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

BASIC TRAINING (BT – II) **Duration: (03) Three Months**		
Week No.	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
1	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.	Selection criteria of file. Vernier bevel protector-reading and use. Use of thread gauge and screw micrometer. Drilling machine-types-drilling operation –drill bits. Reamers-types care & maintenance.
2	Fitting exercise-simple to complex (Involving drilling, tapping, reaming, counter boring & slide fitting).	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.
3	Introduction of engine lathe and parts, holding the job in three & four jaw chuck. Facing and plain turning operations use of measuring tools required for turning.	Manufacturing process in brief outline of various subjects to be covered. Disciplinary rules of the Institute. Training and other facilities available. Introduction to lathe description. Lathe-types of lathe machine, parts of centre lathe and function, lathe operation. Size and specification of a centre lathe. Lathe cutting tools- Types & tools, angle.
4	Facing, Plain and Turning. Taper Turning by compound rest slide methods. Setting threading tool and cutting the external “V” threads.	Work and tools, holding devices of lathe machine. Methods of mounting and dismounting chucks. Taper- types of Taper and their used. Taper turning methods and their calculation.
5	Study types & checking of window, split type air conditioner & their fault finding. Study types & checking of water cooler, deep freezer, ice candy plant.	Air conditioning & its principle, application. Window type, split type air conditioner their types, construction, application & function and trouble shooting. Water cooler, deep freezer, ice candy plant their types, construction, application & function and trouble shooting.

6	a- Study types & checking of air cooler, room cooler & desert cooler. Study type & servicing of heat exchanger.	Air cooler, room cooler & desert cooler their types, construction, application & function and trouble shooting. Heat exchanger their types, construction, application & function and trouble shooting.
7	Speed, R.P.M.& Pressure measurements: Overhauling and testing of speedometer and tachometer. Identification with different types of pressure measurements by meters, gauges, sensors. Repairing, fault finding, testing & calibration with dead weight tester & manometers.	Description, working principle & study speedometer & tachometer. Principle of different types of pressures, liquid pressure, gauge pressure & gas pressure etc. &its meters. Pressure sensors, pressure transducers & instrument.
8	Temperature & flow measurement: Various types of flow meters, maintenance of orifice, venture, flow nozzle & its use. Dismantling, overhauling & calibration of DP cell/ transmitters. Fitting of tapered glass tube, Rota meter checking & testing. Performing practical on temperature measurement with different sensors in temp. Controlled oil bath. Practical on various thermocouples, RTDs & pyrometer. Temperature measuring instrument maintenance & calibration.	Basic properties of fluids, its motion, flow & rate, Reynolds number. Flow measuring devices, study of Rota meter. Temperature, types of heats, various temp. Scales. Bimetallic, fluid filled & electrical temperature instrument (bulbs, capillary, Bourdon tubes, temp. transmitters, and RTD bridge circuits). Pyrometer.
9	Booting the computer ,opening windows menus, using the mouse, refresh computer desktop using right click of the mouse, create a directory in Expand Linux, format a floppy , create a file using notepad, save the file in floppy, copy the file into hard disk, copy a file from hard disk to floppy, create a directory in floppy, create a directory in hard disk, use my documents , use start menu for opening an application , to open a document recently written, change control panel settings for familiarize with keyboard and keys	Introduction to computer fundamentals and its parts, familiarization with disk drives, booting of a computer system, using the windows XP, Linux, menu system, tool bars, file structures, directories, moving and copying a file from floppy to hard disk, hard disk to floppy disk, creating directories. Formatting floppy disk.
10	Techniques of changing desktop wallpaper, changing desktop screen properties, control panel, user accounts,	Use of desktop, control panel settings, explorer, regional settings shortcuts, use of simple applications like paint,

	customizing icon, writing a sample text using notepad, using paint for drawing figures to get accustomed with mouse. Saving a file. Using windows explorer ,install a software , remove a software, add new changing the regional settings of the system (like a printer , change the system date and time, changing the regional setting of the system like country, currency, date format, using start menu, creating desktop short cuts	notepad MS Word MS Excel etc.
11	Microbiology-study of staining, size of microorganism, total plate count. B-Types of distillation for liquid. Purification of substances using different techniques, sublimation error.	Preparation properties & uses-bleaching powder, aluminum chloride. Introduction to microbiology- bacteria cell, nutrition of bacteria, rate of multiplication, sterilization. Distillation & its type & importance.
12	Determination of melting, boiling, flash, pour & freezing points of liquids. Alloy analysis-bauxite, brass	Preparation properties & uses-limestone, cement, soda ash, sodium carbonate, sand, glass, alums & alloys.
13	**Assessment/Examination (03 days)**	

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

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

BT – I		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	Units & measurement- system of units, fundamentals & derived units.	Familiarization with the institute.
2.	Conversion of units & applied problems. FPS, CGS, MKS & SI units.	Introduction to engineering drawing & its importance. Different types of standards used in engineering drawing
3.	Fraction & decimals- addition, subtraction, multiplication & division.	Drawing instruments & their uses- drawing board, T square, set square, protector, drawing sheet, drawing pencils-grade & selection, eraser. Practice lay out of drawing sheet.
4.	Mass, weight, volume & their units. Problems on these, volume of steel, aluminum & copper.	Types of lines- thickness, shade of lines & its general application. Draw types of lines of lines as per IS-70714-1983. Draw figures involving horizontal, vertical & inclined lines.
5.	Simplification of fraction & decimals.	Type of angle, triangle and their types.
6.	Definition- force, pressure, stress, strain & modulus of elasticity.	Practical- construct scalene triangle, right angle, isosceles & equilateral triangle.
7.	Square, square. root, cube root	Lettering style-single stroke letters, gothic letters as per IS standards. Lettering practice.
8.	Plotting & reading of simple graph.	Dimensioning- types of dimension, elements if dimension, method of indicating values, arrangement & indication if dimensions.
9.	Heat, temperature & conversion of scales. Thermometer, thermocouple, pyrometer & its application. Transmission of heat & Coefficient of thermal expansion of solids, liquid & gas & related problems.	Practice- place dimension in the drawing by aligned system & unidirectional system. Give dimension to given drawing by following dimensioning principles as per BIS. Method of dimension common features.
10.	Ratio & proportion - mechanical advantage, velocity ratio & efficiency.	Geometrical construction using drawing instruments-linear, angles, patterns, circle, arc, tangent, quadrilateral, regular polygons, tapers. Related exercise on this topic.

11.	Simple machines - mechanical advantage, v velocity ratio & efficiency.	Practice- constructs square, rectangle, parallelogram, rhombus, trapezium, and quadrilateral. Draw a regular pentagon by circumscribing & inscribing, regular hexagon by arc method, octagon &various types of tapers.
12.	Mensuration - area of circle, triangle, polygons, surface area, volume of cube, sphere, cone, cylinder, hollow cylinder & prism.	Free hand sketching of straight lines, rectangular, circles, squares, polygons, ellipse & its practice.

BT – II		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	Use of logarithms & antilogarithms tables & problems there on multiplication, division, fraction.	Orthographic projection I & III angle- simple machine elements, procedure for preparing a scale drawing.
2.	Newton's law of motion & related problems. Friction & its kinds - advantages & division, fractions.	Draw a plan, elevation & side view of prism, cylinder, frustum of cone, pyramid.
3.	Estimation & cost of finished products.	Draw a plan, elevation & side view of object having stepped blocks with curved surfaces in 1st&3rdangle.
4.	Classification of ferrous &nonferrous metals & alloys, physical &mechanical properties of metal.	Drawing isometric views out of orthographic views.
5.	Algebraic addition, subtraction, multiplication & division. Simultaneous equation, factors & related problems.	Draw the isometric projection of cube, hexagonal prism, cylinder, cone, objects/ blocks with curved surfaces.
6.	Meaning of HP, IHP, BHP, FHP, efficiency, problems on horsepower.	Visualize the shape of object from the given two views and add third view- simple machine element.
7.	Trigonometry- ratio, formulae, area of triangle, height & distance by using trigonometry. Pythagoras theorem.	Identify the lines missed in multi views and supply them, third view for the given two views of similar in shapes & size.
8.	Heat treatment - process of annealing, normalizing, hardening, tempering, case hardening, carburizing, nitriding.	Development of regular objects bounded by plane surfaces- cube, prism, cylinder & cones.
9.	Basic principles of electricity. Ohms law. Use of switch, fuse, conductor, insulator &semiconductor. Series & parallel circuits.'	Draw the development of surfaces of a cube & prism, cylinder, cones.
10.	----------	Explanation of full- sectional view, half sectional view, aligned sections.
11.	----------	Conventions & symbols used on drawing, abbreviations used on engineering drawing, surface finish symbols, welding symbols & annotation.
12.	----------	Blueprint reading of various drawings; take out blueprint from blueprint machine.

9.2EMPLOYABILITY 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 known, 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 cybercrimes.
3. Communication Skills	Duration : 15 Hrs. Marks : 07
Introduction to Communication Skills	Communication and its importance Principles of Effective communication Types of communication - verbal, nonverbal, written, email, talking on phone. Nonverbal communication -characteristics, components-Paralanguage 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 Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises: -Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, the process of setting up a business.
Project Preparation & Marketing analysis	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale &Large-Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.
Institutions Support	Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes& procedure & the available scheme.
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.
5. Productivity	Duration : 10 Hrs. Marks : 05
Benefits	Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation - How improves or slows down.
Comparison with developed countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.
6. Occupational Safety, Health and Environment Education	Duration : 15 Hrs. Marks : 06
Safety & Health	Introduction to Occupational Safety and Health importance of safety and health at workplace.
Occupational Hazards	Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.

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 Housekeeping, 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 fitting operations that require well developed skills in industrial workshop practices and inspect dimensions with standard procedures.
2. Develop profiles as per drawing using standard procedure & tools to ensure appropriate accuracy.
3. Carry out marking of the components as per specification and standard procedure for Hacksawing, filing, drilling, riveting, fitting and allied operations in familiar context.
4. Execute preventive maintenance of lathe machine maintaining proper procedures and test for functionality by appropriate maintenance method.
5. Produce job observing proper procedures using various cutting tools involving different operations viz. Step turning, under cutting / Grooving, Knurling, Drilling, Reaming, Boring.
6. Check different electrical sub system & measure parameters. (Different Electrical sub system AC/DC motor, Alternator, dynamo etc.)
7. Dismantle, check and repair reciprocating compressor, its components and test efficiency of compressor.
8. Conduct electrical measurements using measuring instruments like ammeters, voltmeter and AC/DC meters.
9. Connect bare conductors using soldering method on printed boards.
10. Make simple circuits with a lamp and battery using multimeter, tong tester and megger.

OJT-II:

11. Carry out Preventive and Breakdown maintenance on Periodical and daily basis.
12. Check centrifugal pumps (Single & Multistage) with gland and mechanical seal and its accessories and reciprocating pumps, gear & pumps with its accessories by dismantling and assembling.
13. Dismantle and assemble reciprocating compressor - air refrigerant compressor and its accessories like receiver, chiller, evaporator, expansion valve & safety switches controls. Centrifugal compressor, skew, lobe type compressor etc.
14. Maintain & operate different types of valves - Ball, gate, glove, non-return valve, diaphragm & needle.
15. Carry out maintenance of refrigeration plant with its equipments and safety devices, air conditioning plant with its equipments and safety devices.
16. Dismantle and assemble different types of heat exchangers, gasket cutting choke removal, tube replacement.

17. Assemble and check pipelines having different types of joints like flange, screw, weld etc. & their fittings of accessories.
18. Fix and dismantle different types of bearings like ball, roller, needle, taper roller with the help of different types of attachments.
19. Overhaul and maintain different types of belts, chains, couplings and joints and chain pulley blocks, gearboxes.
20. Carry out NDT and thickness test.

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

MECHANIC MAINTENANCE			
LIST OF TOOLS AND EQUIPMENT for Basic Training			
A. TRAINEES TOOL KIT			
Sl. No.	**Name of the Tool &Equipment**	**Specification**	**Quantity**
1.	Steel rule graduated both in English & metric units	30 cm	17 Nos.
2.	Outside spring caliper	150 mm	17 Nos.
3.	Inside 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 2nd cut	250mm	17 Nos.
11.	Engineers screwdriver		17 Nos.
12.	File flat smooth	200mm	17 Nos.
13.	Cold chisel flat	25x200mm	17 Nos.
14.	Metal stand table for surface plate	900x900x1200mm	2 Nos.
15.	Screwdriver set (multi heads)		1 No.
16.	Scribing block universal	300mm	2 Nos.
17.	V block universal	300mm	2 Nos.
18.	Tri square	150mm	2 Nos.
19.	Outside spring caliper	200mm	2 Nos.
20.	Divider spring	200mm	2 Nos.
21.	Inside spring caliper	200mm	2 Nos.
22.	Sprit level		1 No.
23.	Screwdriver heavy duty	300mm	2 Nos.
24.	Combination set	300mm	2 Nos.
25.	Spindle blade screw driver	100mm	2 Nos.
26.	Dial gauge	o/ 50mm	4 Nos.
27.	Lever type dial gauge	o/50mm	2 Nos.
28.	Dial gauge stand		4 Nos.

29.	Screw pitch gauge set for metric pitches	0,5-7mm	2 Nos.
30.	Radius gauge set metric	1-6mm	1 No.
31.	Allen hexagonal key set	2.5-12mm	2 Nos.
32.	Spanner double ended set (seven pcs.) in metric.		4 Nos.
33.	Adjustable spanner	300mm	2 Nos.
34.	Reduction sleeve MT as required		1 No.
35.	Oil can pressure feed	500m	3 Nos.
36.	Twist drills 3-13mm (parallel shank)		2 Nos.
37.	Drill chuck 0-20mm with taper shank		1 No.
38.	Centre drill A 1-5		2 Nos.
39.	Grinding wheel dresser (star type)		1 No.
40.	C clamps	100mm	2 Nos.
41.	Tap & die set in box metric		1 No.
42.	Hacksaw adjustable	300mm	8 Nos.
43.	Bench vice	150mm jaw	8 Nos.
44.	Magnifying glasses	75mm	2 Nos.
45.	Micrometer outside	0-25mm	4 Nos.
46.	Micrometer outside	25-50mm	2 Nos.
47.	Micrometer depth gauge	0-150mm	2 Nos.
48.	Direct reading vernier caliper	300mm	4 Nos.
49.	Vernier height gauge	250mm	1 No.
50.	Digital vernier caliper	200mm	1 No.
51.	Number/alphabetic punch	100mm	1 No.
52.	Welding transformer	200A	1 No.
53.	Welding cable for above capacity in mtr.		As required
54.	Electrode holder		4 Nos.
55.	Screen helmet		4 Nos.
56.	Pressure Regulator Oxygen double stage		1 No.
57.	Leather gloves pair		4 Nos.
58.	Tongs holding	300mm	4 Nos.
59.	Pressure Regulator Acetylene double stage		1 No.
60.	Arc welding table		4 Nos.
61.	Lugs for cable		As required
62.	Rubber Hose pope for Oxy. & Ace.in mt		As required

63.	Cutting torch Oxy acetylene with tips		2 Nos.
64.	Spark lighter		6
65.	Arc welding Generator set	350A	1 No.
66.	Gas Trolley		1 No.
Milling cutters:			
67.	Side & Face cutter	100x10x27mm	2 Nos.
68.	Side & face cutter	150x15x27mm	2 Nos.
69.	Sine bar	200mm	1 No.
70.	Centre gauge	60 0 55 0	1 No.
71.	Slip Gauge set (normal set) Metric		1 No.
72.	Flange Micro-Meter	0-25mm	1 No.
73.	Limit Plug Gauge	5mm to 25mm by 2.5mm Range	1 No.
74.	Shaping machine 450 mm stroke (Motorized) with all attachments		2 Nos.
75.	Double Column planer 1500x100x1000 mm (Motorized) with all attachments		1 No.
76.	Slotter Machine 180 mm Stroke (Motorized) with all attachments		1 No.
77.	Drilling Machine pillar	20mm capacity	1 No.
78.	Pedestal Grinding Machine	Double ended with 300 mm wheels (one fine and one rough)	1 No.
79.	Universal Milling Machine	Size No.1 with Standard accessories and the following attachments: Universal Indexing head with 03 indexing plat and set of changes gear 01 No. Long arbor 25 and 27 mm 01 each. Machine Vice swivel base 160mm-01 No	1 No.
80.	Milling Machine plain type Horizontal	size No. 1 with standard accessories and the following attachments: Machine Vice swivel base 150mm- 01 No. Long arbor Dia 25 and 27 mm -01 No.	1 No.

		Each	
81.	Milling machine Vertical	size no. 1 with standard accessories and the following attachments: Collette adapter and Collette (standard size) – 01 set. Stab arbor style "C" Dia 22, 27 and 32 mm – 01 set. Rotary Table 300mm with indexing arrangements- 01 No.	1 No.
82.	Lathe General purpose all geared (gap bed)	height of centre 150mm with 3 jaw and 4 jaw chuck, face plat, taper turning attachments, steadies etc.	4 Nos.
83.	Surface grinding Machine	wheel Diaz 180mm reciprocating table, Longitudinal table traverse 200mm.fitted with adjustment traverse stop, magnetic chuck 250mmx 120mm with set of grinding wheels, diamond tools, holders for dressing &set of spanners etc.	2 Nos.
SPARE PARTS / ACCESSORIES			
84.	RELAYS		4 Nos.
85.	Capacitors		4 Nos.
86.	Overload protectors		4 Nos.
87.	Selector switch		4 Nos.
88.	Thermostatic switch		4 Nos.
89.	Flare fitting		2 Nos.
90.	Expansion valve-thermostatic/automatic		6 Nos.
91.	Solenoid valve		2 Nos.
92.	High pressure/ low pressure cut out		2 Nos.
93.	Oil failure switch		2 Nos.
94.	Liquid indicator		2 Nos.
Gas welding equipments			

95.	Goggle pair welder type		16 Nos.
96.	Spark lighter		16 Nos.
Electrical Instruments			
97.	Watt-hour meter2, 5kw electronic type		1each
98.	Ohm meter	100ohms	1 No.
99.	Multi-meter Analog type		2 Nos.
100.	Multi meter digital type	4.5 digit	20 Nos.
101.	Insulation tester	500volt	1 No.
102.	Ampere hour meter	10A	1 No.
103.	Calibration for testing AS/DC ammeters & Volt meters		1 No.
104.	Tester for testing Watt hour meter		1 No.
105.	Ammeter	0-10 A AC/DC MI type	2 Nos.
106.	Ammeter	0-30 AC/ DC MC type	2 Nos.
107.	Voltmeter	0-250V AC/ DC MI type	2 Nos.
108.	Voltmeter	0-5mV AC/ DC	2 Nos.
109.	Rheostat	25ohms, 500ohms	2each
Flow Instruments			
110.	Deflecting vane flow meter		2 Nos.
111.	Rotating vane flow meter		2 Nos.
112.	Helical & turbine flow meter		1each
113.	Pitote tube flow meter		1 No.
114.	Orifice type flow meter		1 No.
Level Instruments			
115.	Hook type level indicator		1 No.
116.	Float type level indicator		1 No.
Optical Instruments			
117.	Microscope low power		1 No.
118.	Theodolites		1 No.
119.	Binocular		1 No.
120.	Telescope		1 No.
Temperature Instruments			
121.	Mercury in glass thermometer		1 No.
122.	Resistance bulb wheat stone bridge type thermometer		2 Nos.
123.	Thermocouple type pyro meter with Milli- voltmeter with different		2 Nos.

	thermocouple		
124.	Optical pyrometer		1 No.
Pressure Instruments			
125.	U tube mano meter		2 Nos.
126.	Bourdon tube pressure gauge		8 Nos.
127.	Pressure regulator gas		2 Nos.
Flow meters			
128.	Simple tank type quantity meter		1 No.
129.	Reciprocating piston type flow meter		2 Nos.
Recorders & Controllers			
130.	Circular chart type recorders		2 Nos.
131.	Strip charts type recorders		2 Nos.
132.	Secondary devices for measurements of temperature, pressure, level & flow for above recorders		2 each
133.	Proportional type electronic controller		2 Nos.
134.	Pneumatic controller for pressure Temperature& flow with accessories		01each
135.	Pneumatic, Hydraulic & Electronic transmitter for above controller & recorder		01each
136.	Pneumatic trainer kit-consisting of cylinders, different types of direction control valves, pressure dependent valves, flow control valves with accessory		2 Nos.
137.	Hydraulic trainer kit with power packed consisting of cylinders, different types of direction control valves flow control valves with accessories.		2 Nos.
FURNITURE:			
138.	Instructor table	1200x760x760mm	1 No.
139.	Instructor chair with arm		1 No.
140.	Steel stools	300x300x450mm	16 Nos.
141.	Work bench	3000x1500x760mm	4 Nos.
142.	Discuss table	3000x1200x760mm	1 No.
143.	Steel locker with eight compartments		4 Nos.

144.	Steel almirah	1980x900x450mm	4 Nos.
145.	Bookshelf	4 drawer	1 No.
146.	Steel rack	4 shelf	3 Nos.
147.	Black board with stand		1 No.
148.	Fire extinguisher CO2		2 Nos.
149.	Fire bucket with stand		4 Nos.
150.	Artificial respiration chart		4 Nos.
151.	First aid box		1 No.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: MECHANIC MAINTENANCE

LIST OF TOOLS& EQUIPMENTS FOR -20APPRENTICES

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

2) Infrastructure:

A : TRAINEES TOOL KIT:-			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1.	Draughtsman drawing instrument box		21
2.	Set square celluloid	45^o (250 X 1.5 mm)	21
3.	Set square celluloid	30^o-60^o (250 X 1.5 mm)	21
4.	Mini drafter		21
5.	Drawing board	700mm x500 mm IS: 1444	21
B : Furniture Required			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1.	Drawing Board		20
2.	Models: Solid & cut section		as required
3.	Drawing Table for trainees		as required
4.	Stool for trainees		as required
5.	Cupboard (big)		01
6.	White Board	(size: 8ft. x 4ft.)	01
7.	Trainer's Table		01
8.	Trainer's Chair		01

TOOLS & EQUIPMENT 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 FORMATIVE ASSESSMENT

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