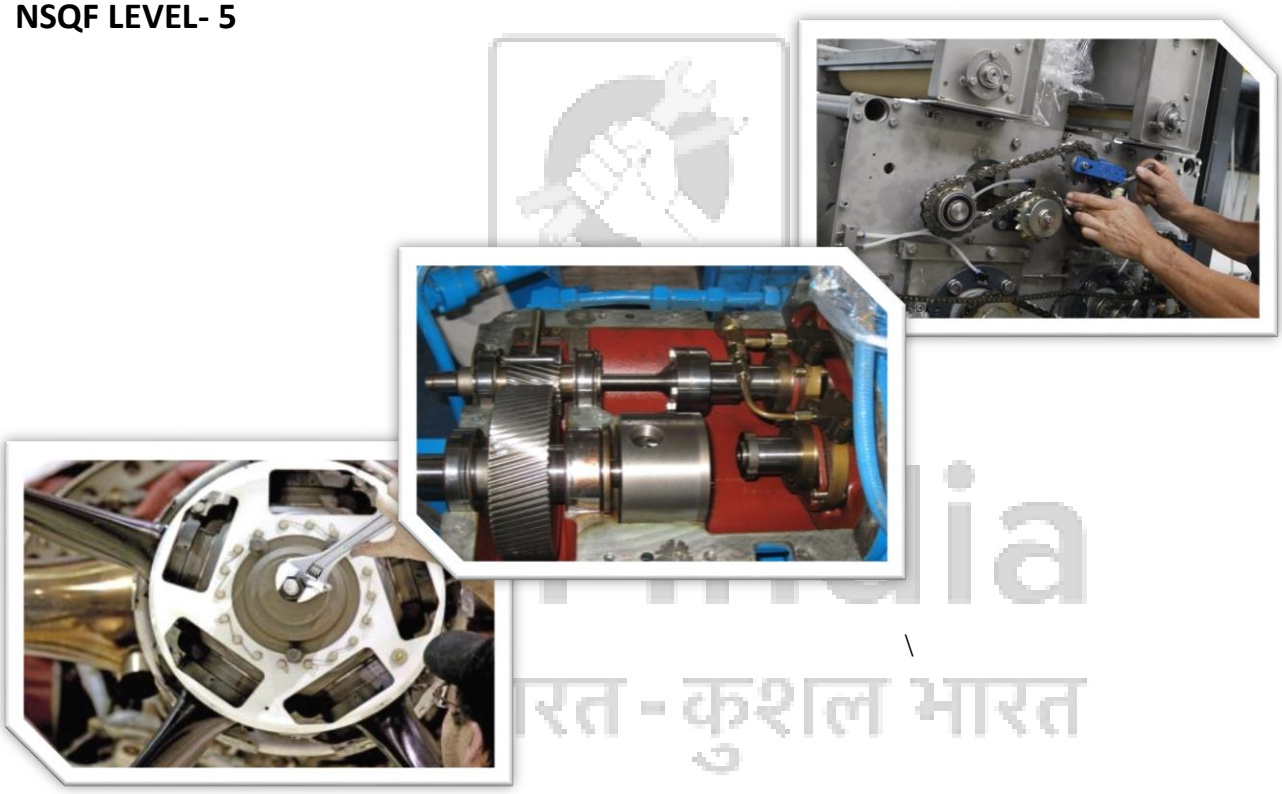
MECHANIC MACHINE TOOL MAINTENANCE

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5



SECTOR – PRODUCTION & MANUFACTURING

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

MECHANIC MACHINE TOOL MAINTENANCE

(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

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Co-ordinator for the course: Sh. N. Nath, ADT, CSTARI- Kolkata

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Expert Group Designation
1.	N. Nath, ADT	CSTARI, Kolkata	Expert
2.	R. N. Manna, T.O.	CSTARI, Kolkata	Expert
3.	N.M. Kajale, Principal,	Govt. ITI Velhe, Distt: Pune.	Expert
4.	S. Bandypadhyay, T.O.	ATI, Kolkata	Expert
5.	G.Lepakshappa, T.O	ATI, Mumbai	Expert

CONTENTS

1. BACKGROUND

1.1 Apprenticeship Training Scheme under Apprentice Act 1961

The Apprentices Act, 1961 was enacted with the objective of regulating the programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate(ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry**.** There are four categories of apprentices namely**; trade apprentice, graduate, technician and technician (vocational) apprentices.**

Qualifications and period of apprenticeship training of **trade apprentices** vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department of Education, Ministry of Human Resource Development.

1.2 Changes in Industrial Scenario

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

1.3 Reformation

The Apprentices Act, 1961 has been amended and brought into effect from 22nd December, 2014 to make it more responsive to industry and youth. Key amendments are as given below:

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.
- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.
- Scope has been extended also to non-engineering occupations.
- Establishments have been permitted to outsource basic training in an institute of their choice.
- The burden of compliance on industry has been reduced significantly.

2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of NCVT for propagating vocational training.

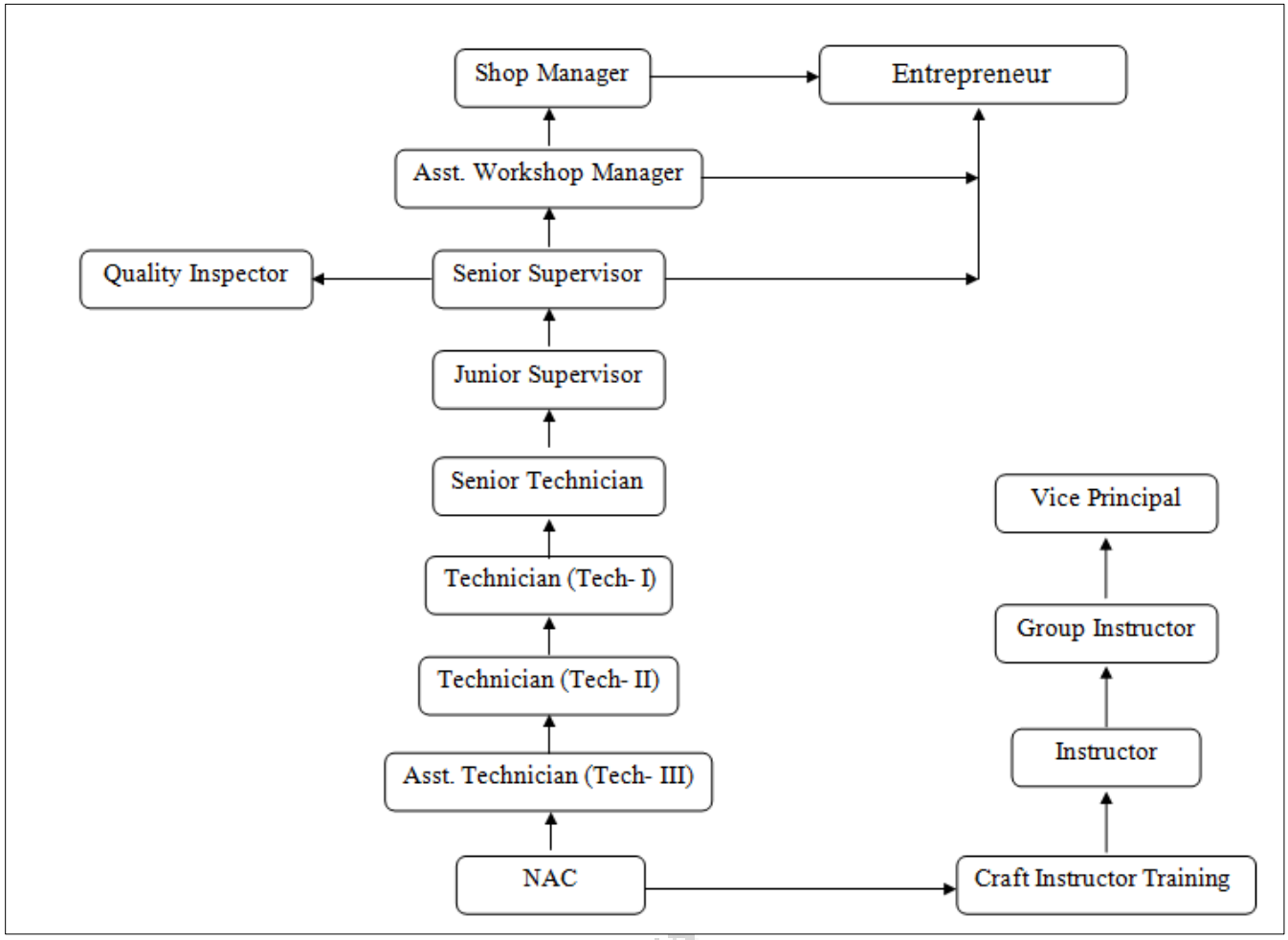
Mechanic Machine Tool Maintenance trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, while Core area - Workshop Calculation and science, Engineering Drawing and Employability Skills imparts requisite core skills & knowledge and life skills. After passing out the training programme, the trainee is being awarded National Apprenticeship Certificate (NAC) by NCVT having worldwide recognition.

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/document, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge, core skills & employability skills while performing jobs and solve problem during execution.
- Check the job/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:

- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Indicative pathways for vertical mobility.



2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of two years (*Basic Training and On-Job Training*) : -

Total training duration details: -

Time (in months)	1-3	4-12	13-15	16-24
Basic Training	**Block– I**	**-----**	**Block – II**	**------**
Practical Training (On - job training)	**----**	**Block – I**	**------**	**Block – II**

A. Basic Training

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

Sl. No.	Course Element	Total Notional Training Hours	
		For 02 Yrs. course	**For 01 Yr. course**
1.	Professional Skill (Trade Practical)	550	275
2.	Professional Knowledge (Trade Theory)	240	120
3.	Workshop Calculation & Science	40	20
4.	Engineering Drawing	60	30
5.	Employability Skills	110	55
	Total (Including internal assessment)	**1000**	**500**

B. On-Job Training:-

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

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

For 01 yr. course (Engg.) :-(**Total 12 months**)

Notional Training Hours for On-Job Training: 2080 Hrs.

C. Total training hours:-

Duration	Basic Training	On-Job Training	Total
For 02 yrs. course (Engg.)	1000 hrs.	3120 hrs.	4120 hrs.
For 01 yr. course (Engg.)	500 hrs.	2080 hrs.	2580 hrs.

2.4 ASSESSMENT & CERTIFICATION:

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by Govt of India from time to time. The Employability skills will be tested in first two semesters only.

a) The **Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NAC will be conducted by NCVT on completion of course as per guideline of Govt of India. The pattern and marking structure is being notified by govt of India from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%. The candidate pass in each subject conducted under all India trade test.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration should be given while assessing for team work, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

Evidences of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examination body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weight age in the range of 60 -75% to be allotted during assessment	
For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • Below 70% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b) Weight age in the range of above75% - 90% to be allotted during assessment	
For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A good level of neatness and consistency in the finish • Little support in completing the project/job
(c) Weight age in the range of above 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment • Above 80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief description of Job roles:

Mechanic Machine Tool Maintenance

Installs, erects and changes layout of machines and equipments in mills, factories, workshops etc. according to instructions or specifications. Studies drawings and lay out sketches of machines or equipment to be erected. Calculates available floor area in relation to dimension of machines, working space required etc. and marks areas on floor for foundations of machines. Guides' construction of foundations and setting of foundation bolts and fixtures according to type of machines to be installed and allows foundations to dry up and settle for required number of days. Places base or holding device of machines through foundation bolts or on fixture one by one, using lifting equipment and aligns and levels them with spirit level. Fastens or secures machines tightly to foundation bolts or fixtures and rechecks alignment and leveling to ensure correctness. Makes adjustment if necessary and gets grouting of foundations done. Allows grouting to dry up and adjust position of different parts of machine for efficient operation. Gives necessary power supply to machine or connects machine to line shaft. May run machine and observe performance. May assemble, repair and overhaul machines. May specialize in erecting particular type of machine or equipment such as printing machine, lathe, pneumatic hammer, grinder, pumps, etc.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

Perform TPM (Total Production Management), TQM (Total Quality Management) and record keeping system.

Reference NCO & NOS:

i) **NCO-2015 : 8211.1000 –** Erector, Machine and Equipment
ii) **NCO-2015 : 8211.0100 -** Assembler, Workshop Machine and Equipment

4. NSQF LEVEL COMPLIANCE

NSQF level for Mechanic Machine Tool 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 Machine Tool 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 Machine Tool Maintenance**
NCO - 2015	8211.1000, 8211.0100
NSQF Level	Level – 5
Duration of Apprenticeship Training (Basic Training + On-Job Training)	Two years (02 Blocks each of one year duration).
Duration of Basic Training	a) Block –I : 3 months b) Block – II : 3 months **Total duration of Basic Training: 6 months**
Duration of On-Job Training	a) Block–I: 9 months b) Block–II : 9 months **Total duration of Practical Training: 18 months**
Entry Qualification	Passed 10th Class with Science and Mathematics under 10+2 system of Education or its equivalent
Selection of 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 time to time for the specific trade.
Infrastructure for Basic Training	As per related trades of ITI
Examination	The internal examination/ assessment will be held on completion of each block. Final examination for all subjects will be held at the end of course and same will be conducted by NCVT.
Rebate to Ex-ITI Trainees	01 year
CTS trades eligible for MMTM Apprenticeship	1. MMTM

Note:

- *Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.*
- *For imparting Basic Training the industry to tie-up with ITIs having such specific trade and affiliated to NCVT.*

6. LEARNING OUTCOME

6.1 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Mechanic Machine Tool Maintenance course of 02 years duration under ATS.

Block I & II:-

1. Recognize & comply safe working practices, environment regulation and housekeeping.

2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*

3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*

4. Select and ascertain measuring instrument and measure dimension of components and record data.

5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.

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

7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.

8. Plan and organize the work related to the occupation.

6.2 SPECIFIC LEARNING OUTCOME

Block – I

1. Safety and best practices/Basic Industrial Culture (5S, KAIZEN, etc.)
2. Prepare different types of documentation as per industrial need by different methods of recording information.
3. Perform marking out the components for filing, drilling, fitting and allied operations.

4. Align the grinding wheel of Pedestal grinding machine.
5. Application of hand tools and their applications, specifications e.g. power tools, torques wrench etc.
6. Understanding and practice of ISO tolerance system.
7. Carry out chipping operation on flat surfaces. Develop flat surface by scraping and check surface finish.
8. Dismantle, Repair and Assemble of mechanical power transmission elements in machine tools and check for functionality. Joining of flat belt in belt drive. Checking and setting of belt tension and replacing the defected one.
9. Mounting and demounting of bearings.
10. Interpretation of lubrication chart of a machine tool.
11. Set up different work and tool holding device on lathe, Shaper required to accomplish tasks on these machines with required alignment.
12. Conduct preventive & break down maintenance of lathe, drilling and shaper and ensure functionality of the machine.
13. Make / Produce different joints by setting up of gas and arc welding machines and carry out the welding.
14. Make pipe/tube fittings and valve connections for lubricants and coolants, test for leakages,
15. Conduct the preventive maintenance, Trouble shoots & overhaul of milling and surface grinding machines.
16. Identify and test basic electronic components of viz., resistor, capacitors & inductor using multimeter and assemble simple battery eliminator circuit, measure its Input & Output voltages. Basic understanding of sensors and their adjustments.
17. Trouble shoot & Overhaul of pumps, fans, blowers & compressors and perform preventive maintenance

Block – II

18. Prepare machine foundation for erection, install of heavy duty machines and carry out geometrical tests.
19. Practice on insulation of machine against vibrations, Use of anti- vibration counting.
20. Installation of machines like power hammer, compressors furnaces and other related machines.
21. Conduct the preventive maintenance, reconditioning of general purpose machines- Air compressors, power hammer, pumps and other related machines.

NOTE: *Learning outcomes are reflection of total competencies of a trainee and assessment will be carried out as per assessment criteria.*

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING OUTCOME	
LEARNING OUTCOMES	**ASSESSMENT CRITERIA**
1. Recognize & comply safe working practices, environment regulation and housekeeping.	1. 1. Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	1. 2. Recognize and report all unsafe situations according to site policy.
	1. 3. Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1. 4. Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	1. 5. Identify and observe site policies and procedures in regard to illness or accident.
	1. 6. Identify safety alarms accurately.
	1. 7. Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1. 8. Identify and observe site evacuation procedures according to site policy.
	1. 9. Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1. 10. Identify basic first aid and use them under different circumstances.
	1. 11. Identify different fire extinguisher and use the same as per requirement.
	1. 12. Identify environmental pollution & contribute to avoidance of same.
	1. 13. Take opportunities to use energy and materials in an environmentally friendly manner
	1. 14. Avoid waste and dispose waste as per procedure
	1. 15. Recognize different components of 5S and apply the same in the working environment.
2. Understand, explain different mathematical calculation & science in the	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,

field of study including basic electrical and	heat treatment, centre of gravity, friction.
apply in day to day work.*[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*	2.2 Measure dimensions as per drawing
	2.3 Use scale/ tapes to measure for fitting to specification.
	2.4 Comply given tolerance.
	2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges.
	2.7 Explain basic electricity, insulation & earthing.
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*	3. 1. Read & interpret the information on drawings and apply in executing practical work.
	3. 2. Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.
	3. 3. Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
4. Select and ascertain measuring instrument and measure dimension of components and record data.	4.1 Select appropriate measuring instruments such as micrometers, vernier calipers, dial gauge, bevel protector and height gauge (as per tool list).
	4.2 Ascertain the functionality & correctness of the instrument.
	4.3 Measure dimension of the components & record data to analyse the with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	5.1 Explain the concept of productivity and quality tools and apply during execution of job.
	5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.
	5.3 Knows benefits guaranteed under various acts

6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.
	6.2 Dispose waste following standard procedure.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	7. 1. Explain personnel finance and entrepreneurship.
	7. 2. Explain role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
	7. 3. Prepare Project report to become an entrepreneur for submission to financial institutions.
8. Plan and organize the work related to the occupation.	8. 1. Use documents, drawings and recognize hazards in the work site.
	8. 2. Plan workplace/ assembly location with due consideration to operational stipulation
	8. 3. Communicate effectively with others and plan project tasks
	8. 4. Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.
SPECIFIC OUTCOME	
Block-I & II	
*Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under **block – I & block – II** (section: 10) must ensure that the trainee achieves well developed skill with clear choice of procedure in familiar context. Assessment criteria should broadly cover the aspect of **Planning** (Identify, ascertain, estimate etc.); **Execution** (perform, illustration, demonstration etc. by applying 1) a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information 2) Knowledge of facts, principles, processes, and general concepts, in a field of work or study 3)Desired Mathematical Skills and some skill of collecting and organizing information, communication) and **Checking/ Testing** to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.*	

8. SYLLABUS

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1.	Safety: - its importance, classification, personal, general, workshop and job safety. Occupational health and safety. Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Importance of housekeeping & good shop floor practices. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Fire& safety: Use of Fire extinguishers.	Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Institute system including stores procedures. Introduction of First aid. Safety attitude development of the trainee by educating him to use Personal Protective Equipment (PPE). Response to emergencies eg; power failure, fire, and system failure. Accidents- Definition types and causes. First-Aid, nature and causes of injury and utilization of first-aid. Introduction to 5S concept & its application. Fire: - Types, causes and prevention methods. Fire Extinguisher, its types. Define environment, environment Pollution, Pollutants, type of Pollution (Air pollution, water pollution, soil pollution noise pollution, thermal pollution, radiation. Global warming its causes and remedies. Industrial Waste its types, sources and waste Management.
2.	Identification of tools & equipments as per desired specifications for marking &	Hand tools and its importance, steel rule, Try square, chisel, surface gauge

	sawing(Hand tools , Fitting tools & Measuring tools) Selection of material as per application Visual inspection of raw material for rusting, scaling, corrosion etc. Uses of marking tools, Punch, Try square & basic measuring tools, caliper, steel rule. Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions, sawing different types of metals of different sections Filing Flat surfaces, Tee shape job, flat type polygon, checking with steel rule and Try square. Marking and Drilling holes on flat pieces. Tapping as per simple drawing.	and care & maintenance, Hacksaw frame, blades. Classification and types of chisels, files & uses, vices - its constructions and uses. Hammers and its types. Related safety. Marking block, Steel rule, and calipers- different types and uses. Combination set-its components and uses. Hacksaw blade, Hacksaw frame and its types. Drill bits- parts, Types & uses. Introduction to Hand Taps & Dies and their types, applications, care and maintenance. Familiar with tap and drill size, Thread Terminology. Use of vernier caliper and its parts, construction, principle & reading, use & care.
3.	Understand and usage of different measuring instruments e.g. bore gauge, dial indicator, edge finder. Checking and setting of Vernier calipers, vernier height gauge &vernier bevel protractor. Filing flat, square, steps and contour surfaces to an accuracy of 0.4 mm	Linear measurements & its units. Classification, construction, materials and functional detail of following basic measuring and marking tools : - • Steel Rule • Calipers(Inside & outside), • Divider, Trammel • Try Square • Marking Punch Measuring Instruments viz., Vernier calipers, vernier height gauge &vernier bevel protractor.
4.	Chipping practice on flat surface, slots & oil grooves, and chamfer at different angle on MS plate. Scraping practice on curved surfaces. Preparation of flat surfaces and scraping practice on flat surface taking impression on face high spots using prussian blue sharpening by diamond dresser & wheel and lapping stone.	Precision Measuring Instruments: Concept of precision & accuracy Micrometer (outside, inside and depth) -working principle, construction, use & care, calculation of least count Classification, construction and functional detail of following marking devices- Surface plate, angle plate, marking block and V- Block.

		Scrapers: Introduction, its types, material and use.
5	Demo & practice of different operation of lathe machine, mounting and dismantling of different turning tools on machines. Different practical exercises with different accuracy levels. Identification of various parts of Drilling machines. Use of drilling machine for drilling through & blind holes, counter boring and counter sinking on mild steel (MS) flat. Drilling on cylindrical surface. Reaming of drilled hole. Making internal & external thread by Taps & Dies.	Identification of different parts, accessories, attachments', operations and tools used in drilling machines. Types of drilling machines like bench, pillar & radial drilling machines and their constructional details. Types of drilling operations, calculation of cutting speed, feed & drilling time. Introduction to lathe, identification of different parts, accessories, attachments', operations and tools used in lathe machines. Basic mechanism of metal cutting and process parameters, their effect on product quality.
6	Demo & practice of different operation on milling machine, mounting and dismantling of different milling cutters on milling machines. Different practical exercises with different accuracy levels. Grinding practice of Drill.	Introduction to milling machine identification of different parts, accessories, attachments', operations and tools used in milling machines. **Fasteners:** Introduction to fasteners, screw threads, related terminology and specification. Keys- types & use, (parallel, sunk, tangential, gib head, woodruff, key ways.) Types of nuts, bolts, studs, locking devices for nut, wrench and spanner, pliers, screw drivers, Circlip, split pin, washers, spring washer. Concept of torque & torque wrench. Different types of rivets and their applications.
7.	Filing & fitting mating components by filing within an accuracy of ± 0.10 mm & angular 1°	Surface finish - importance, symbol, measuring techniques. Lapping & honing process. **Gauges:** Classification and uses of Sine bar, Slip gauge, Limit gauge, Feeler gauge,

		thread gauge, screw pitch gauge, taper gauge. **Tolerances & interchangeability** -Definition and its necessity, basic size, actual size, limits, deviation, Tolerance, allowance, clearance, interference, Fits-definition, types, description with sketches. Method of expressing Tolerance as per BIS, Hole and Shaft basis (BIS standard). Related calculation on Limit, Fit and Tolerance.
8-9	Demo & practice of different operation on grinding machines, mounting and dismantling of grinding wheels on grinding machines. Different practical exercises with different accuracy levels. Demo & practice of different operation on Shaper machine, mounting and dismantling of tools & jobs on Shaper machine. Different practical exercises with different accuracy levels.	Introduction surface and cylindrical grinding machine, identification of different parts, accessories, attachments', operations and tools used in grinding machines. Selection of grinding wheels, balancing and mounting of grinding wheels. **Taps & Dies:** Classification, construction, material and functional detail of Taps & Dies. Pedestal grinder - Introduction, care & use. Procedure of wheel mounting & wheel dressing. Related hazards, risk and precautions.
10.	Demo and practical's on different welding techniques.	Definition and application of welding. Different types of basic welding and explain the basic welding techniques and execute different welding
11.	Identify different basic electrical & electronic components and test their functioning.	Basic Electricals: Safety in electrical shop. Measurement of current, voltage, resistance and power. Use of multimeters. Basic principles of DC generators and motors, Alternators and AC motors and transformers. Various types of switches, circuit breakers, fuses, lamps, proximity switches, relays and contactor in electrical circuits. **BASIC ELECTRONICS** Introduction to electronics and its industrial applications.

		Different electronic components viz., resistor, capacitors & inductor and their function.
12.	Installing drive belts, Measuring and adjusting the belt tension. Related hazards, risk and precautions while working.	**Belts-** Belt types (Flat and V) and specifications. Pulleys used for belt drive. Installation, Alignment of belts. Problems related to belts(Creep and slip) Belt maintenance. Sheave alignment, Chain drive- Roller chain, Silent chain, alignment of sprockets, and maintenance of chain drive.
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 (Block – II)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1	Identification and study of various components of mechanical power transmission assembly System. Dismantling & assembly of Shafts, couplings, keys, gears, bearings, belts, chain pulley, rope pulley. Related hazards, risk and precautions while working.	**Maintenance Practice and Mechanical Assembly** Introduction to various maintenance practices such as preventive maintenance, predictive maintenance, breakdown maintenance & reconditioning. **Transmission of Power** Elements of mechanical power transmission, type of spindles and shafts (Universal spindle, Plain shaft, Hollow shaft, crank shaft, cam shaft). Positive and Non-positive drive, Friction drive, Gear drive, Belt drive, Chain drive and Rope drive.
2.	Identification of various types of clutches, clutch arrangements in power transmission system (machine tools), maintenance of clutch mechanism in machine tool. Dismantling & assembly of mechanical & electromagnetic assembly. Measuring shaft and coupling bore for finding out taper & ovality to determine the type of fit. Identification of different types of Brakes & Functioning of Braking mechanism in machine tools. Inspection of components of Brakes & braking mechanism.	**Clutches** Function of Clutches, its types and use in power transmission system. Function of mechanical & electromagnetic system in clutch mechanism. **Couplings:** Concept of coupling and its type viz. Rigid coupling- Muff coupling, Flange coupling, Flexible coupling, Pin-bush coupling, Chain coupling, Gear coupling, Spider coupling, Tyre coupling, Grid coupling, Oldham-coupling, Fluid coupling, Universal coupling and their specific applications. **Brakes&** Braking Mechanism: Types & Functions. Inspection of brakes for safe & effective working.
3.	**Hydraulic & pneumatic** circuit reading practice & constructing hydraulic circuits for single & double acting cylinders, meter in, meter out circuit, pressure control circuits & regenerating circuit.	Basic principle of Hydraulic& pneumatic system. Advantages & limitation. Constructional & functional details of Hydraulic & pneumatic cylinder, mo tor, control valves and

		FRL unit.
4.	Identification of various types of Gears & Gear boxes. Inspection of various aspects of Gears & Gear boxes such as PCD checking by Cylindrical Pin, Checking of gear tooth thickness, clearance, concentricity & wear etc. Gear meshing: Checking of backlash and root clearances with Feeler Gauge, Dial Test Indicator and Lead Wire. Repair of gear tooth. Shaft alignment, Pre-check: coupling fit, eccentricity, perpendicularity, with feeler, dial gauge and corrections methods. Checking misalignment with the help of Taper gauge, Feeler gauge and Dial test indicator Geometrical Alignment and accuracy of Machine as per the test chart of machine tool builder	**Bearing:** Description and function of bearing, its types -Solid Bush, Split Bush, Collar, Pivot and Plummer Block Bearing. Mounting of bearings, measurement and adjustment of clearances in bearings. Types of bearing fitting on shaft and hubs. Type of Roller contact bearings- Ball bearings-single row & double row, Deep groove ball bearing, Angular contact, Self aligning and Thrust bearing. Roller bearing- Cylindrical, Needle roller, Taper roller, Spherical roller, self aligning and Spherical roller thrust bearing. Use of ISO bearing designation code to generate market survey and purchase. Checking and adjustment of bearing clearance. Methods of Mounting and dismounting of roller contact bearing, taper roller bearing and angular contact ball bearing. (Back-to-back, Face-to-face, tandem) Mounting-dismounting and adjustment of Taper bore bearings with adopter and withdrawal sleeve. Handling and storage of bearings. Related hazards, risk and precautions.
5-6.	Practice on oil removing & filling from gear box. Inspection of the drained oil for contaminants & wear debris with focus on visual inspection. Overhauling procedure of gear box (Pre cleaning, dismantling, cleaning, inspection, repair/ replacement, assembly) of lathe & milling m/c Preparation of coolants. Identification of various parts of cooling systems. Preventive & breakdown	**Gear:** Type, description and function of gears- Spur, Helical, Spiral, Bevel, Straight and Spiral bevel, Worm gears, Rack and pinion. Gear Terminology. Gear train- simple, compound, reverted and epicyclic. Types of Gear box Gear meshing: Checking of backlash and root clearances with Feeler Gauge,

	maintenance of coolant systems.	Dial Test Indicator and lead wire. Impression testing of gear mesh with Prussian blue. Running maintenance. Related hazards, risk and precautions Lubrication and its importance, lubricating systems Types and properties of Oil and Grease. Methods of oil lubrication-Once through and centralized lubrication system. Methods of grease lubrication system- grease guns, centralized lubrication system. Warning & protective devices used in centralized lubrication system (Pressure switch, temperature gauge, level indicator and relief valve.) Lubrication fittings. Storage and handling, Contamination control. Leakage prevention-Shaft seals, sealing devices and "O" rings
7.	Perform repairs of worn out parts of machine tools. Practice soldering. Disassembling & assembling of bearing.	MACHINE FOUNDATION Methods employed for installation & erection of precision & heavy duty machines. Location & excavation for foundation. Different types of foundations - foundation bolts, structural, reinforced, wooden, isolated foundations. Breakdown Maintenance, Preventive Maintenance, Predictive Maintenance & Concepts of TPM, OEE.(without calculations) Difference between breakdown and preventive maintenance - Its importance in productivity, types.
8.	Dismantling & Assembly of various parts &sub assemblies of milling machine such as head stock, gear box, lead screw, table, etc	**Leveling** Definition and importance of leveling. Types of levels- Spirit level, Water level, Dumpy level, Method of leveling. Preparation of packing and shim. **Alignment:** Definition and importance of alignment,

		Types of misalignment, Planes of misalignment, Shaft vs. coupling alignment, Actions to be taken before alignment, Concept of axial float, Concept of Indicator sag, Dial Test Indicator, Methods of alignment - Rim and Face readings on Stationary Machine, Rim and Face reading on machine to be seamed. Geometrical Alignment of Machine. **Balancing** Understanding importance of balancing and reasons of unbalance. Type of unbalance. Method of static balancing and its correction -Adding and removing mass - Mass centering.
9.	Identification of various types of fans, Blowers, their parts. Dismantling, cleaning and assembly of parts. Identification of various types of compressors, their parts. Starting and stopping of compressors Cleaning and changing of filters Preventive & schedule maintenance of Blower & Compressor.	Fan & Blowers: Types and working principle Constructional detail of Fans & Blowers. Starting and stopping of Fans and Blowers Different parts of Fans & Blowers Concept of surge. Preventive & scheduled maintenance. Compressors: Compression theory, Types of compressors Constructional detail of compressors, working mechanism Different parts and their function. Loading unloading system Concept of air dryer. Preventive & schedule maintenance.
10.	Identification of various types of centrifugal pumps, their parts. Overhauling of pump. Priming of pump, Fitting gland packing. Starting and stopping of pumps. Trouble shooting in pump operation. Preventive and schedule maintenance of pumps.	Centrifugal Pump, Fan, Blower and Compressor: - Function of pump. Types and working principle of centrifugal pump. Constructional detail of pump Starting and stopping Pump performance and characteristics. Capitation & aeration. Preventive & schedule maintenance of pumps. Gland packing changing procedure. Concept of Mechanical seal Trouble shooting in pump.

11-12.	Revision of Dismantle, inspect and do minor repairs and assemble machine tools such as drill, shaper, lathe and power saw machines. Practice of dismantling & assembly of feed units of milling, grinding etc.	Introduction to CNC lathe and machining center, constructional details, Mechanical, electrical and Electronic elements of CNC machine, CNC Part program. Study of hydraulic diagram, hydraulics valves etc. Programmable logic controller (PLC) - General concept of working, Relay Logic Control vs. PLC, Block diagram, applications.
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.*

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block – I		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	**Units & Measurements-** FPS, CGS, MKS/SI unit, unit of length, Mass and time. Fundamentals and derived units Conversion of units and applied problems	Engineering Drawing: Introduction and its importance Different types of standards used in engineering drawing. 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
2.	**Material Science** : properties -Physical & Mechanical, Types -Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals	Lines : Types and applications in Drawing as per BIS SP:46-2003 Drawing geometrical object using all types of lines. **Drawing of Geometrical Figures:** Angle, Triangle, Square, Rectangle and Circle. **Letters: -** Lettering styles, Single stroke letters and numbers as per IS standard. Lettering practice.
3.	**Mass .Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density	**Dimensioning-** Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement, Alignment and indication of dimensions. **Scales** :-Types use and construction. Representative factor of scale.
4.	**Speed and Velocity:** Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation. Average Velocity, Acceleration & Retardation. Related problems. Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - - Isometric vie
5.		**Constructions: -** Draw proportionate free hand sketches of plane figures. Sketch horizontal, vertical and inclined line by free hand, Draw circles by

		free hand using square and radial line method, Draw arcs and ellipse by free hand **Ratio & Proportion** : Simple calculation on related problems. **Percentage:** Introduction, Simple calculation on related Problems.
6.		Projections: Concept of axes plane and quadrant. Orthographic projections Method of first angle and third angle projections (definition and difference) Symbol of 1st angle and 3 rd angle projection as per IS specification. Free hand Drawing of Orthographic projection from isometric/3D view of geometrical blocks **Work, Power and Energy:** work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy. Meaning of H.P., I.H.P., B.H.P., and F.H.P. and CC and Torque.

Block – II		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	**Screw :-** Its Types and Sizes, Screw thread, their standard forms as per BIS, external and internal thread.
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, radiatio	**Rivets and Joints:-** Prepare a drawing sheet on rivets nomenclature and Joints.
3.	**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids -cube, cuboid, cylinder and Sphere. Surface area of solids -cube, cuboid, cylinder and Sphere. Volume of cut-out solids: hollow cylinders, frustum of cone, block section. Volume of simple solid blocks	Free hand Sketches for simple pipe line with general fittings
4.	**Basic Electricity:** Introduction, use of electricity, how electricity is produced, 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 earthling	Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries
5.	**Simple machines Transmission of power:** - Transmission of power by belt, pulleys & gear drive. **Heat treatment process: -** Heat treatment and advantages. Annealing, Normalizing, Hardening, Tempering	Simple exercises related to trade related symbols. Basic electrical and electronic symbol
6.	**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding the value of unknown sides and angles of a triangle by Trigonometrical method.	Free hand sketch of trade related components / parts /cutting tool indicating angles

	Finding height and distance by trigonometry. Application of trigonometry in shop problems. (viz. taper angle calculation). Calculate the area of triangle by using trigonometry and application of Pythagoras theorem,	
7.	**Concept of pressure** -**Definition**:-Force, Pressure, and their units, atmospheric pressure, gauges used for measuring pressure, problems. Introduction to pneumatics & hydraulics systems **Concept of pressure** – units of pressure, atmospheric pressure, gauge pressure – gauges used for measuring pressure. **Introduction to pneumatics & hydraulics systems.** Solution of NCVT test papers	
	Simple exercises related to trade related Test Papers. Solution of NCVT test papers.	

9.2 EMPLOYABILITY SKILLS

(DURATION: - 110 HRS.)

Block – I (Duration – 55 hrs.)	
1. English Literacy Duration : 20 Hrs.	Marks : 09
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
Functional Grammar	Transformation of sentences, Voice change, Change of tense, Spellings.
Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking / Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. I.T. Literacy Duration: 20 Hrs.	Marks : 09
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
Computer Operating System	Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.
Word processing and Worksheet	Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.
Computer Networking and Internet	Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.

3. Communication Skills Duration: 15 Hrs.	Marks : 07
Introduction to Communication Skills	Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.
Motivational Training	Characteristics Essential to Achieving Success. The Power of Positive Attitude. Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning.
Facing Interviews	Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview.
Behavioral Skills	Problem Solving Confidence Building Attitude
Block – II **(Duration – 55 hrs.)**	
4. Entrepreneurship Skills Duration : 15 Hrs.	Marks : 06
Concept of 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	Project formation, Feasibility, Legal formalities i.e., Shop Act,

Procurement	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: -

Block – I

1. Safety and best practices/Basic Industrial Culture (5S, KAIZEN, etc.)
2. Prepare different types of documentation as per industrial need by different methods of recording information.
3. Perform marking out the components for filing, drilling, fitting and allied operations.
4. Align the grinding wheel of Pedestal grinding machine.
5. Application of hand tools and their applications, specifications e.g. power tools, torques wrench etc.
6. Understanding and practice of ISO tolerance system.
7. Carry out chipping operation on flat surfaces. Develop flat surface by scraping and check surface finish.
8. Dismantle, Repair and Assemble of mechanical power transmission elements in machine tools and check for functionality. Joining of flat belt in belt drive. Checking and setting of belt tension and replacing the defected one.
9. Mounting and demounting of bearings.
10. Interpretation of lubrication chart of a machine tool.
11. Set up different work and tool holding device on lathe, Shaper required to accomplish tasks on these machines with required alignment.
12. Conduct preventive & break down maintenance of lathe, drilling and shaper and ensure functionality of the machine.
13. Make / Produce different joints by setting up of gas and arc welding machines and carry out the welding.
14. Make pipe/tube fittings and valve connections for lubricants and coolants, test for leakages,
15. Conduct the preventive maintenance, Trouble shoots & overhaul of milling and surface grinding machines.
16. Identify and test basic electronic components of viz., resistor, capacitors & inductor using multimeter and assemble simple battery eliminator circuit, measure its Input & Output voltages. Basic understanding of sensors and their adjustments.
17. Trouble shoot & Overhaul of pumps, fans, blowers & compressors and perform preventive maintenance.

Block – II

18. Prepare machine foundation for erection, install of heavy duty machines and carry out geometrical tests.

19. Practice on insulation of machine against vibrations, Use of anti- vibration counting.
20. Installation of machines like power hammer, compressors furnaces and other related machines.
21. Conduct the preventive maintenance, reconditioning of general purpose machines- Air compressors, power hammer, pumps and other related machines.
22. Conduct the preventive maintenance, overhaul and check the functionality of the Hydraulic & Pneumatic systems of machine tools. Perform fault finding and attend break downs of different hydraulic and pneumatic machineries / equipment's viz., hydraulic press, Power hammer in the shop floor.
23. Referring the machine maintenance manual and retrieve the spare part details (for ordering purpose).
24. Specification systems for standard mechanical elements e.g. bearings, seals, V Belts, gear, fasteners and locking fasteners, springs, keys and pins.
25. Interpretation and preparation of dismantling and assembly plan and sequence for different machine elements.
26. Drawing and drafting of machine part as per requirement (in case of worn out/ modification)
27. Understanding of Statistical Process Control (SPC) and machine capability indices.
28. Perform repairs of worn out parts of machine tools and check their function ability.
29. Perform Inspection & Condition Monitoring of different types of machine tools used in shop floor.
30. Perform applications of resistor, capacitor conductor components Testing & measurement of their values and soldering and de-soldering of component on printed circuit boards **(PCB)** precautions to be taken while soldering on PCB
31. Trouble shooting of mechanical elements in PLC with case studies
32. Perform overhauling, trouble shooting of various types of pumps, their parts.
33. Perform Practical Demo on CNC lathe and CNC machining centre operation, its essential parts. Functioning of each part.
34. Diagnose and fault finding on CNC lathe and CNC machining centre and perform mechanical maintenance work in CNC machines.
35. Conducting overhaul of compressors Cleaning and changing of filters Preventive & schedule maintenance of Blower & Compressor.
36. Perform TPM (Total Productive Maintenance), TQM (Total Quality Management) and record keeping system

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 MACHINE TOOL MAINTENANCE			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)			
A.1 TRAINEES TOOL KIT (For each additional unit trainees tool kit is Required)			
Sl. no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
1	Steel Rule 15 cm both side Graduated in Metric & English.	15 cm	21 nos.
2	Center punch 100 mm	100 mm	21 nos.
3	File flat 2nd cut 250 mm	250 mm	21 nos.
4	File flat bastard 350 mm	350 mm	21 nos.
5	File flat smooth 200 mm	200mm	21 nos.
A2. TRAINEE TOOL KIT (ONE FOR GROUP OF 5 TRAINEES			
1	Hermaphrodite Caliper 150 mm	150 mm	4 nos
2	Try Square 150 mm	150 mm	4 nos
3	Hack Saw frame adjustable 250-300 mm with blades.	250-300 mm	4 nos
4	Hammer ball peen 400 gm with handle.	400 gm	4 nos
5	Hammer ball peen 400 gm with handle.	400 gm	4 nos
6	Cross Chisel 10x150 mm	10x150 mm	4 nos
7	Half Round Chisel 10x150 mm	10x150 mm	4 nos
8	Diamond point Chisel 10x150 m	10x150 mm	4 nos
9	File Half round 2nd cut 250 mm	250 mm	4 nos
10	File triangular smooth 200 mm	200 mm	4 nos
11	File round smooth 200 mm	200 mm	4 nos
12	File square smooth 200 mm	200 mm	4 nos
13	Round nose pliers 200 mm	200 mm	4 nos
14	Combination pliers 200 mm	200 mm	4 nos

15	Scraper A 250 mm (Bearing)	250 mm	4 nos
16	Scraper B 250 mm (Triangular)	250 mm	4 nos
17	Scraper D 250 mm (Half Round)	250 mm	4 nos
18	Spindle blade screw driver 100 mm	100 mm	4 nos
19	Allen keys 2 to 16 mm (Hexagonal)	2-16 mm	4 nos
B.INSTRUMENTS AND GENERAL SHOP OUT FIT			
1.	Tap and die set M6, M8, M10, M12, M16, M20 & M25 with necessary tap wrench and die holder.	set M6, M8, M10, M12, M16,M20 & M25	1 each
2.	Spanner socket set of 25 pieces (10 to 25, 27, 30, 32, mm = 18 pcs and assorted = 7 nos.)	25 pieces (10 to 25, 27, 30, 32, mm = 18 pcs and assorted = 7 nos.)	1no.
3.	Hammer soft (faced 30 mm dia.) plastic tipped.	30 mm dia.	As required
4.	Pipe wrench 450mm	450mm	As required
5.	Chain pipe wrench 650 mm	650 mm	As required
6.	Telescopic gauges 13 mm to 300 mm.	13 mm to 300 mm	As required
7.	Tap Extractor		1 no.
8.	Linear Actuator (Differential and non-differential)		1 each
9.	Cut section model of Pneumatic vales		1 no.
10.	Vibrometer		As required
11.	Flow Detector		1 no.
12.	Magnetic crack detector		1 no.
13.	Engineers Stethoscope		As required
14.	Stud Extractor		1 no.
15.	Tool picker collate type		As required
16.	Tool picker magnetic type		As required
17.	Magnifying Glass 75 mm		1 no.
18.	Pin spanner set		1set
19.	Hand keyway breacher		As required

20.	C.I. Surface plate 400 x 400 mm with stand and cover	400 x 400 mm	As required
21.	Head lamp		1 no.
22.	Bearing and gear tester		As required
23.	Master test bars (Different sizes)		1 no.
24.	Spirit Level 150 mm, accuracy 0.02 mm / 1000 mm	150 mm, accuracy 0.02 mm / 1000 mm	2 nos.
25.	3 Cells Torch		2 nos.
26.	Gasket Hollow punches 5, 6, 8, 10, 12, 19, 25 mm dia.	5, 6, 8, 10, 12, 19, 25 mm dia.	2 nos.
27.	Bar type Torque Wrench		1 each
28.	Cam lock type Screw Driver		1 no
29.	Flaring tools		1 no
30.	Tube Expander up to 62 mm	up to 62 mm	2 no
31.	Circlip Pliers (inside, outside and straight)		2 set
32.	Sledge hammer 5 Kgs.	5 Kgs	1 each
33.	Viscometer		1 no
34.	Vernier height gauge 300 mm	300 mm	1 no.
35.	Maintenance tool kit trolley of 1200 x 800 x1200 mm (L x W x H)	1200 x 800 x1200 mm (L x W x H)	1 no.
36.	Steel lockers for 20 trainees		As required
37.	Steel cupboard 180 cm x 60 cm x 45 cm	180 cm x 60 cm x 45 cm	2 nos.
38.	Workbench 240 cm x 120 cm x 75 cm (Each bench fitted with 4 vices)	240 cm x 120 cm x 75 cm	6 nos.
39.	Bench Vice with 100 mm jaw	100 mm jaw	20 nos.
40.	Letter punch 5 mm set		1 Set
41.	Number punch 5mm set		1 Set
42.	Deep cutting hacksaw frame 300 mm	300 mm	1 No
43.	Bearing puller		1 No
C. PRECISION INSTRUMENTS			
1.	Vernier Bevel protractor with 150 mm blade	150 mm	1nos.

2.	Vernier caliper 200 mm with Inside and depth measurements	200 mm	2nos
3.	Dial vernier caliper 200 mm, with 0.02 mm least count	200 mm, with 0.02 mm least count	1nos
4.	Optical Bevel protractor		1nos
5.	Outside micrometer 0 to 25mm	0 to 25mm	1nos
6.	Outside micrometer 25 to 50 mm	25 to 50 mm	1nos
7.	Outside micrometer 50 to 75 mm	50 to 75 mm	1nos
8.	Combination set with 300 mm blade centre head, square head and protector head.	300 mm	1nos
9.	Sine bar 200 mm	200 mm	1nos
10.	Slip Gauge Box (workshop grade) - 87 pieces per set	- 87 pieces per set	1nos
11.	Inside micrometer 50 mm to 200mm, 0.01 mm least count with six extension rod.	50 mm to 200mm, 0.01 mm least count	1nos
12.	Gear tooth Micrometer (metric)		1nos
13.	Bevel gauge 200 mm	200 mm	1nos
14.	Dial test indicator – Plunger type-Range 0-10 mm , Graduation 0.01 mm & 0.001mm Reading 0-10 with revolution counter (complete with clamping devices and magnetic stand)	Range 0-10 mm , Graduation 0.01 mm	1set
15.	Dial test indicator – Puppitast type-Range 0-10 mm , Graduation 0.01 mm & 0.001 mm. Reading 0-10 with revolution counter (complete with clamping devices and magnetic stand)	-Range 0-10 mm , Graduation 0.01 mm & 0.001 mm.	1set
16.	Feeler gauge		1nos
17.	Radius gauge 1 to 25 mm radius	1 to 25 mm radius	1nos

18.	Screw pitch gauge for metric, standard & fine pitches. BSP & BSW pitches (0.25 to 6 mm)	(0.25 to 6 mm)	1nos
19.	Center gauge 55º x 47½º	55º x 47½º	1nos
20.	Center gauge 60º	60º	1nos
21.	Plug gauge Morse taper No.1, 2, 3, 4,	Morse taper No.1, 2, 3, 4,	1set
22.	Ring gauge Morse taper No.1, 2, 3, 4,	Morse taper No.1, 2, 3, 4,	1set
23.	Ring gauge Ø20mm (Go and No Go)	Ø20mm	1nos
24.	Limit plug gauges Ø20mm	Ø20mm	1nos
25.	Wire gauges		1nos
26.	Bore gauge with dial indicator (1 mm range, 0-0.01 mm graduation)-Range of bore gauge 18-150 mm)	18-150 mm	1nos
27.	Straight edge 485 mm to 1445 mm	485 mm to 1445 mm	1nos
28.	Bearing fitting tool		1nos
29.	Multimeter		2nos
30.	Tong tester		1nos
31.	Megger		1nos
32.	Wire stripper cum cutter		1nos
33.	Crimping Tool		1nos
D. LATHE TOOLS:			
1.	Reduction sleeve and extension socket.		As required
2.	Centre drills 3, 4 and 5 mm (Consumable)	3, 4 and 5 mm	2 nos. each
3.	Revolving centre with arbor		As required
4.	Knurling tool with holder (straight, cross, diamond)		1 each

5.	Dog carrier		As required
6.	Oil can pressure feed		As required
7.	Tool holder (straight) to suit 6 & 8 mm sq. bit size	6 & 8 mm sq.	As required
8.	Tool holder (straight) to suit 6 & 8 mm sq. bit size	6 & 8 mm sq.	As required
E. MILLING MACHINE TOOLS:			
1.	Cylindrical milling cutter Ø 63 x 70 x Ø 27 mm	Ø 63 x 70 x Ø 27 mm	1 no.
2.	Side and face cutter Ø 80 x 10 X Ø 27 mm	Ø 80 x 10 X Ø 27 mm	1 no.
3.	Slitting Saw cutter Ø 100 x 6 X Ø 27 mm	Ø 100 x 6 X Ø 27 mm	1 no.
4.	Slitting Saw cutter Ø 75 x 3 X Ø 27 mm	Ø 75 x 3 X Ø 27 mm	1 no.
5.	„T" slot cutter with parallel shank- Ø 17.5 x 8 mm width x dia. of shank 8 mm	Ø 17.5 x 8 mm width x dia. of shank 8 mm	1 no.
6.	Woodruff key seating cutters A 13.5x3, A16x4	A 13.5x3, A16x4	1 each
7.	Parallel shank end mill Ø 5 mm, Ø 6 mm, Ø 8mm, Ø 10 mm and Ø 12 mm	Ø 5 mm, Ø 6 mm, Ø 8mm, Ø 10 mm and Ø 12 mm	1 each
8.	Disc type form milling cutter (involutes form -1.5 & 2 module, 20° pressure angle)	1.5 & 2 module, 20° pressure angle)	As required.
9.	Scribing block universal 300mm	300mm	As required.
10.	V-Block-Approx 65x65x80 mm with clamping capacity of 50 mm with clamps	65x65x80 mm	1 set each.
11.	V-Block-Approx 65x65x80 mm with clamping capacity of 50 mm with clamps	65x65x80 mm	1 set
12.	Angle plate-adjustable 250x250x300 mm	250x250x300 mm	1 no.
13.	Twist Drill Parallel Shank Ø 4 mm to Ø 12 mm in steps of 0.5 mm	Ø 4 mm to Ø 12 mm	1each.

14.	Grinding wheel dresser (diamond dresser) with holder 1.5 carat diamond	1.5 carat diamond	1 no.
15.	C – clamp- 50 mm & 75 mm	50 mm & 75 mm	1 each
16.	Hand reamer 6 to 16 mm in steps of 1 mm	6 to 16 mm in steps of 1 mm	1 each.
17.	Machine reamer 6 to 16 mm in steps of 1 mm	6 to 16 mm in steps of 1 mm	1 each
F.GENERAL MACHINERS			
1	Lathe all gear head type, with Centre height of 150 mm, Gap bed, between centers 1000 mm (with 3 jaw and 4 jaw chuck, coolant equipments).	Centre height of 150 mm, Gap bed, between centers 1000 mm	2 nos
2	Universal Milling machine		1 no
3	Surface grinding machine wheel dia 180 mm (or near) reciprocating table, longitudinal table traverse 200mm (or near) full motorized supplied with magnetic chuck 250 X120mm and necessary accessories	wheel dia 180 mm	1no
4	Drilling machine pillar type 20mm capacity	20mm capacity	1 no
5	Double ended Pedestal Grinder with 178 mm wheels(one fine and one rough)- motorized with twist drill grinding attachment	178 mm wheels	1 no
6	Flexible Hand Grinder 100 mm dia – light duty	100 mm dia – light duty	1 no
7	Portable Drilling machine 6 mm capacity.	6 mm capacity	
8	Shaping Machine 450 mm stroke (motorized) with all attachments	450 mm stroke	1 no
9	Pipe bending machine		1 no
10	Hydraulic trainer with necessary elements for different machine circuit with all types of transparent valves and pressure gauge, reservoir etc		1 set

11	Pneumatic trainer with necessary elements for demonstration different machine circuit with all types of valves, pressure gauge and compressor etc.		1 set
G. OLD MACHINES FOR JOB WORK (REPAIR & RECONDITIONING)			
1	Old Centre lathe		1no
2	Old Milling Machine (Universal)		1 no
3	Old Grinding Machine (Universal		1 no
4	Old Shaping Machine		1 no
5	Old Gear Box (any type)		1 no
6	Old Gear Box (any type)		1 no
7	Old hydraulic power pack with hydraulic cylinder		1 no
8	Old hydraulic power press		1no
9	Old Gear pump		1 no
10	Old Vane pump fixed and variable deliver		1each
11	Old Piston pump (Radial & Axial)		1 each
H. WELDING WORK **(If w 1. GAS WELDING trade is available in the institute may be used-otherwise to be provided as per list** **1. GAS WELDING**			
1	Oxy-acetylene welding Cylinder Trolley		1 no
2	Welding hose P.V.C. flexible internal dia. 6 mm (Blue and red)		5 m
3	Hose coupling Nipples		2 nos
4	Hose Protractor		2 nos
5	Double stage Pressure regulator for Oxygen and Acetylene		1 no each
6	High Pressure blow pipe with tips		1 no
7	Gas cutting torch with cutting tips		1 no
8	Welding gloves pair (Leather)		1 pair
9	Goggles (4A) for Gas. Welding		4 nos
10	Spark lighter		2 nos
11	Spindle key		1no

ARC WELDING -

(**If welding trade is available in the institute may be used-otherwise to be provided as per list given below**)

Sl. No	Name of tools and equipments	Quantity
1	Welding Machine DC or AC, (Single phase / 3 phase), 150 – 300 Amps capacity with all accessories	
1. ERECTION TOOLS		
S. No	**Name of tools and equipments**	**Quantity**
1	Foundation bolts (different types)	1each.
2	Plumb bob	1 no.
3	Square Box Wrenche	1 no
4	Square Box T Wrenches	1 no
5	Engineers square 700 mm	1 no
6	Threaded Fastener B Type	1 no
7	Threaded Fastener C Type	1 no
8	Threaded Fastener F Type	1 no
9	Hoisting Equipment: chain pulley, steel slings, rope, belt, tackles	1 set

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND
Quantity
ENGINEERING DRAWING

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

TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS		
Sl. No.	**Name of the Equipment**	**Quantity**
1.	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software.	10 Nos.
2.	UPS - 500VA	10 Nos.
3.	Scanner cum Printer	1 No.
4.	Computer Tables	10 Nos.
5.	Computer Chairs	20 Nos.
6.	LCD Projector	1 No.
7.	White Board 1200mm x 900mm	1 No.
Note: - Above Tools & Equipments not required, if Computer LAB is available in the institute.		

FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor :			**Year of Enrollment :**
Name & Address of ITI (Govt./Pvt.) :			**Date of Assessment :**
Name & Address of the Industry :			**Assessment location: Industry / ITI**
Trade Name :	**Semester:**		**Duration of the Trade/course:**
Learning Outcome:			

Sl. No	**Candidate Name**	**Father's/Mother's Name**	Safety consciousness	Workplace hygiene	Attendance/ Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to handle tools & equipment	Economical use of materials	Speed in doing work	Quality in workmanship	VIVA	**Total internal assessment Marks**	**Result (Y/N)**
Maximum Marks (Total 100 Marks)			**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														