MACHINIST (GRINDER)

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

MACHINIST (GRINDER)

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
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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.

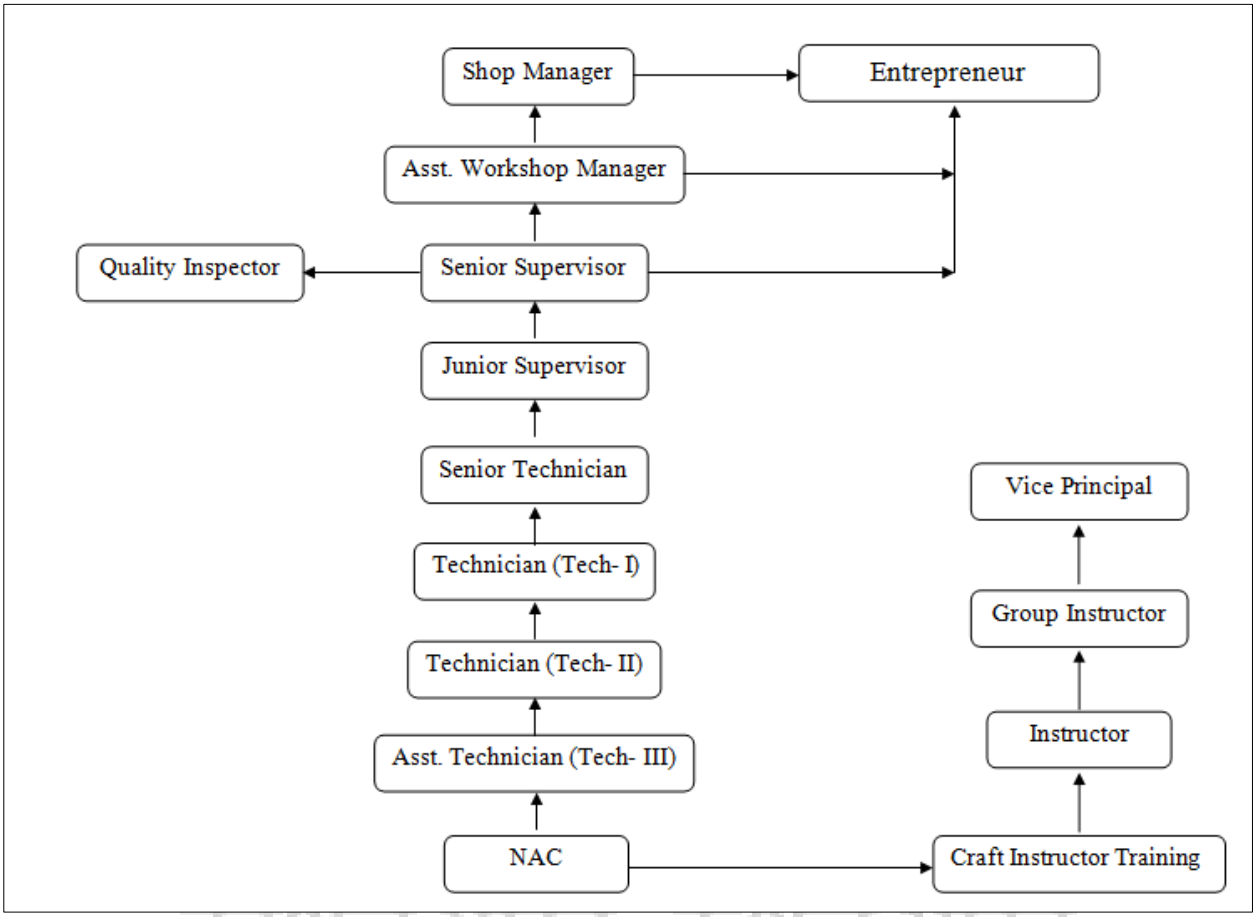
Machinist (Grinder) trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge,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

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/document, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge, core skills & employability skills while performing jobs and solve problem during execution.
- Check the job/finishing and assembly as per drawing for functioning, identify and rectify errors in job/assembly.
- Document the technical parameters related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS:

- 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.)

S 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 (section-2.4.2). The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NAC will be conducted by NCVT on completion of course as per guideline of Govt of India. The pattern and marking structure is being notified by govt of India from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline (section-2.4.2) before giving marks for practical examination.

2.4.1 PASS REGULATION

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

2.4.2 ASSESSMENT GUIDELINE

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

Assessment will be evidence based comprising the following:

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

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

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

3. JOB ROLE

Brief description of Job roles:

Grinder grinds machine tools and cutter to correct specifications by special grinding machines and wheel. Studies drawings and other specifications to understand nature of grinding operation required. Fastens appropriate abrasive wheel to spindle of machine. Mounts cutting tool to be ground on machine using dividing head, jig or fixture as required. Manipulates swivel tables, wheel head and work holding device, guide finger, etc. as necessary to set machine to appropriate angle for grinding desired level on cutting edges of tool selects and sets speed and feed to machine according to nature of work and wheel used. Starts machine, brings rotating grinding wheel in contact with edge of tool and grinds proper angles, clearance, flutes etc. as required on tool or cutter set, frequently checking it with gauge or measuring instrument while grinding to ensure accuracy. Rotates work through proper angle by dividing head or otherwise to set next flute or teeth of tool or cutter for grinding and continues operation. Uses cutting fluid or coolant as found necessary and ensures that no part of work gets burnt or damaged while grinding. Stops machine and removes tool when grinding is completed. Changes grinding wheel and position of tool as and when required. May give final finish to cutting edge by hand using hones. May oil and clean machine. May specialize in grinding a particular type of tool and be designated accordingly. May check ground tool or cutter by shadow projector to ensure accurate finish.

Grinder Operator makes metal articles to required specifications using lathe and cutting tools. Studies drawings and other specifications of parts to be made. Selects metal, holds it in chuck, jig or fixture on lathe as required, centres it by manipulating chuck jaws or otherwise using dial indicator or marking block and securely tightens it in position. Selects correct cutting tool, grinds it if necessary and holds it tight in tool post at correct height. Sets feed and speed and starts machine. Manipulates hand wheels or starts automatic controls to guide cutting tool into or along metal. Controls flow of coolant (cutting lubricant) on edge of tool. Arranges gears in machine to obtain required pitch for screw cutting. Calculates tapers and sets machine for taper turning, controls lathe during operation by means of hand wheels and levers and frequently checks progress of cutting with measuring instruments such as calipers and rule, micrometers, etc. Stops machine, removes completed part and checks it further with instruments to ensure accuracy. 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 2015:

1. 7224.0100 Grinder, General
2. 7224.0300 Roll Grinder
3. 7224.0400 Surface Grinder
4. 7224.0401 Grinder – Hand-Held and Power Tools
5. 7224.0500 Thread Grinder
6. 7223.0701 Lathe Machinist
7. 7223.2200 Grinder, Tool and Cutter

4. NSQF LEVEL COMPLIANCE

NSQF level for Machinist (Grinder) trade under AT S: **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 Machinist (Grinder) 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	MACHINIST (GRINDER)
NCO-2015	7224.0100, 7224.0300, 7224.0400, 7224.0401, 7224.0500, 7223.0701
NSQF Level	Level – 5
Duration of Apprenticeship Training (Basic Training + On-Job Training)	Two years (02 Blocks each of one year duration).
Duration of Basic Training	a) Block –I : 3 months b) Block – II : 3 months **Total duration of Basic Training: 6 months**
Duration of On-Job Training	a) Block–I: 9 months b) Block–II : 9 months **Total duration of Practical Training: 18 months**
Entry Qualification	Passed 10th Class with Science and Mathematics under 10+2 system of Education or its equivalent
Selection of Apprentices	The apprentices will be selected as per Apprenticeship Act amended time to time.
Instructors Qualification for Basic Training	As per ITI instructors qualifications as amended time to time for the specific trade.
Infrastructure for Basic Training	As per related 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 Machinist (Grinder) Apprenticeship	1. Machinist (Grinder). 2. Machinist. 3. Turner

Note:

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

6. LEARNING OUTCOME

6.1GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Machinist (Grinder) course of 02 years duration under ATS.

Block I & II:-

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*
4. Select and ascertain measuring instrument and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Plan and organize the work related to the occupation.

6.2 SPECIFIC LEARNING OUTCOME

Block – I

1. 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 chipping, filing, drilling, counter boring, countersinking, reaming and taping.
4. Types of cutting fluids, their application and inspection e.g. cutting oil concentration, PH value.
5. Interpretation and their effect of various process parameters e.g. feed rate, surface speed, machining time etc.

6. Perform grinding wheel checking, balancing, mounting, dressing, truing and setup automatic movement of table for surface & cylindrical grinder.
7. Set and produce the job with general tolerance on surface and cylindrical grinder.
8. Setup and produce long cylindrical parallel job, taper job, eccentric job, using cylindrical grinder and check for accuracy.
9. Setup and produce internal straight cylindrical parallel job, using internal cylindrical grinder and check for accuracy without any assistance.
10. Perform the grinding of different types of metals such as cast iron, bronze, aluminium, carbide tip and different class of steel by dry and wet grinding method.
11. Setup and produce V- block, cube, parallel bar snap gauge, ring gauge, plug gauge, taper pin to close tolerances and check for accuracy.
12. Perform preventive maintenance of grinding machines.
13. Monitoring of system pressure, abnormal heating, noise and vibrations and action to be taken.
14. Recording of inspection results into control charts (SPC) and understanding of these charts.

Block – II

15. Perform thin plate grinding using coolant to close limits within ±0.005 mm.
16. Perform slot grinding on surface grinding machine to close limit (within ±0.005 mm) and check for accuracy without any assistance.
17. Perform different types of bore grinding within accuracy (within ±0.005 mm) and check for accuracy.
18. Interpretation and measurement of different quality aspects e.g. surface finish, diameter and geometric tolerances.
19. Usage of gauges and comparators, specially pneumatic and electronic gauging system.
20. Understand working of tool and cutter grinder, set and resharpen the plain/slot/side and face milling cutter and check for accuracy.
21. Set and resharpen the slitting saw, spiral milling cutter, end mill cutter, angular milling cutter, tap, reamer drill, and check for accuracy.
22. Perform form grinding viz., angular, concave, convex using cylindrical and surface grinder.
23. Perform steep taper, morse taper, lathe centre grinding up to close limit and check for accuracy.
24. Grind different precession components viz. dowel pin, sinebar, slip gauges.
25. Understand working of external and internal centreless grinder and perform different types of grinding operation using through feed, in feed and end feed and check for accuracy.

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26. Setting up of centerless grinding for the jobs with different diameter and length and Trouble shooting for grinding defects in centerless grinding e.g. patch marks, spiral marks, chattering marks and taper.
27. Understand working of thread grinding machine tool and perform different types of thread grinding and check for accuracy.
28. Understand working of CNC surface and/or grinder and perform different types of flat job grinding and check for accuracy.
29. Understand working of CNC tool and cutter grinder and perform resharpening of different types of single point tool & milling cutter and check for accuracy. (Optional)
30. Perform basic preventive maintenance of CNC grinding machines.
31. Perform TPM (Total Productive Maintenance), TQM (Total Quality Management) and record keeping system.
32. Heat treat plain carbon steel.
33. Anneal and bend copper pipes to different shapes
34. Handle Jigs and Fixtures
35. Make simple Limit Gauges and Templates
36. Solder and joint ferrous and non ferrous component (soft and hard).
37. Familiarization with pumps, air compressor, pneumatic tools and hydraulic driver machines.
38. Accuracy testing of Machine tools such as geometrical parameters.
39. Dismantling and mounting of pulleys.
40. Use simple jigs and fixtures for drilling.
41. Dismounting, repairing damaged gears and mounting and check for workability.
42. Repair & replacement of belts and check for workability.
43. Maintenance, troubleshooting, and safety aspects of pneumatic and hydraulic systems (The practical for this component may demonstrated by video)

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 authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1.8 Identify and observe site evacuation procedures according to site policy.
	1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1.10 Identify basic first aid and use them under different circumstances.
	1.11 Identify different fire extinguisher and use the same as per requirement.
	1.12 Identify environmental pollution & contribute to avoidance of same.
	1.13 Take opportunities to use energy and materials in an environmentally friendly manner.
	1.14 Avoid waste and dispose waste as per procedure.
	1.15 Recognize different components of 5S and apply the same in the working environment.
2. Understand, explain different mathematical calculation & science in the field of study including	2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction.

basic electrical and apply in day to day work.*[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*	2.2 Measure dimensions as per drawing
	2.3 Use scale/ tapes to measure for fitting to specification.
	2.4 Comply given tolerance.
	2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges.
	2.7 Explain basic electricity, insulation & earthing.
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing- Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*	3.1 Read & interpret the information on drawings and apply in executing practical work.
	3.2 Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.
	3.3 Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
4. Select and ascertain measuring instrument and measure dimension of components and record data.	4.1 Select appropriate measuring instruments such as micrometers, vernier calipers, dial gauge, bevel protector and height gauge (as per tool list).
	4.2 Ascertain the functionality & correctness of the instrument.
	4.3 Measure dimension of the components & record data to analyse the ith given drawing/measurement.
5. Explain the concept in productivity, quality tools,	5.1 Explain the concept of productivity and quality tools and apply during execution of job.

and labour welfare legislation and apply such in day to day work to improve productivity & quality.	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 (Section:10)	
*Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under **block – I & block – II**(section: 10) must ensure that the trainee achieves well developed skill with clear choice of procedure in familiar context. Assessment criteria should broadly cover the aspect of **Planning** (Identify, ascertain, estimate etc.); **Execution** (perform, illustration, demonstration etc. by applying 1) a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information 2) Knowledge of facts, principles, processes, and general concepts, in a field of work or study 3)Desired Mathematical Skills and some skill of collecting and organizing information, communication) and **Checking/ Testing** to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.*	

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1	1. Safety: - its importance, classification, personal, general, workshop and job safety. 2. Occupational health and safety. 3. Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. 4. Preventive measures for electrical accidents & steps to be taken in such accidents. 5. Importance of housekeeping & good shop floor practices. 6. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. 7. 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. Global warming its causes and remedies. Industrial Waste its types, sources and waste Management.
2	8. Identification of tools &equipments as per desired specifications for marking & sawing(Hand tools , Fitting tools & Measuring tools) 9. Selection of material as per application Visual inspection of raw material for rusting, scaling, corrosion etc. 10. Uses of marking tools, Punch, Try square & basic measuring tools, caliper, steel rule. Marking out lines, gripping suitably	Hand tools and its importance, steel rule, Try square, chisel, surface gauge, calipers- different types and uses and care & maintenance, Hacksaw frame, blades. Classification and types of chisels, files & uses, vices - its constructions and uses. Hammers and its types. Related safety. Hacksaw blade, Hacksaw frame and its types. Drill bits- parts, Types & uses.

	in vice jaws, hacksawing to given dimensions, sawing different types of metals of different sections. 11. **Practical on marking, punching and rough grinding on pedestal grinder.** 12. Filling practice. 13. Grinding of Chisels, Measuring different types of jobs by steel rule caliper etc.	Introduction to Grinding trade and machine safety precautions according to IS: 1991-1962. General measuring tools (used in grinding shop) their description, use care and maintenance
3	14. Drilling different sizes of holes. 15. Practice tapping and threading with tap &dies. 16. Centre lathe and parts, setting of jobs and 17. Parallel turning, taper turning using compound rest. 18. Grinding of turning tools of various angles.	Brief description of drilling machine, use and care. Relation between drill & tap sizes, care of taps and dies and their correct use. Types, properties and selection of coolants and lubricants. Heat treatment process Annealing, Normalizing, Tempering, Hardening, case hardening and its importance. Brief description of a Centre lathe, its use. Lathe, Lathe tools and their uses. Taper turning methods i.e. Form tool, Taper Turning attachment, Compound rest etc. and calculations.
4	19. V-thread cutting (External) 20. Measurement of different types of job by steel rule, caliper etc. Taper by angular protractor.	Method of screw cutting simple calculation. Thread and its element types. Ferrous and nonferrous metal and their identification by different methods. **Application and use of pedestal grinder.**
5-6	21. Demonstration on selection of grinding wheels for grinding different metals, selection of suitable wheel to obtain rough and IS: 1249- 1958. 22. Grinding different metals with suitable grinding wheels. 23. Setting grinding wheel on wheel flange, truing and balancing of wheels. Dressing of grinding wheel 24. Grinding practice on surface and cylindrical grinding machine. 25. Checking measuring various types of jobs using micrometers, Vernier caliper,	General dressing tools used in grinding section such as wheel, diamond dresser, steel type dresser, abrasive dresser and nonferrous dresser. Precision instruments English and metric micrometer, vernier caliper, dial test indicator etc. their description and uses. Principle and value of grinding in finishing process, various types of grinding wheels their construction and characteristic glazed and loaded wheels. Marking system of grinding wheels IS: 551-

	Vernier 26. Height gauge etc. 27. Grinding sockets and checking depth by depth gauge micrometer.	1966. Depth micrometer and vernier caliper. Common types of surface grinding machine, plain surface, rotary surface, horizontal and vertical surface grinder etc. Method of grinding tapers.
7	28. Machine setting for automatic movements and parallel grinding on cylindrical grinder. 29. Testing and mounting wheels sleeves, truing and rebalancing and grinding parallel mandrel. 30. Wheel balance and dressing grinding long bar using steady rest.	Common types of grinding machines. Plain cylindrical external and internal cylindrical grinder and universal grinder. Test for alignment and checking, balancing at wheel, dressing different types of wheel, dressers, their description and uses. Test for alignment and checking, balancing of wheel, dressing different types of wheel, dressers their description and uses. Holding devices such as Magnetic chuck, chucks and face plates collets their description and uses. Method of holding jobs on magnetic chuck, face plate and chucks.
8	31. Table alignment with the help of test bar and dial test indicator parallel grinding and taper grinding (by swiveling machine table)	External grinding operational steps in external grinding of a job and precautions to be taken. Holding devices such as jig and fixture angle plates 'V' blocks etc. their description and uses. Internal grinding operational steps in internal grinding of a job precautions to be taken.
9	32. Dry and wet grinding of different classes of metals such as cast iron, barzed carbide tip and different classes of steel. 33. Grinding square block angle plate and angular block.	Grinding of bushes and cylinders steps and precautions to be taken. Rough and finish grinding limit fit and tolerances as per ISI: 919-1963. Basic size and its deviation, position of tolerances as per ISI: 919-1963. Basic size and its deviation, position of tolerance zones with respect of zero line. Fits different types clearance, interference and transition. Interchangeable system. Letter symbols for holes and shaft and fundamental deviation hole basis and shaft basis system. Heat generated in grinding dry and wet grinding use of coolant, their composition

		and selection. Characteristic of coolant.
10	34. Grinding practice on drills reamers andtaps. 35. Checking tapered or angular jobs with help of sine bar, Dial gauge.	Methods of grinding of drills reamers and taps. Methods of grinding of milling cutters such as slitting saws, side and face milling cutter etc. Use of snap gauges, sine bar and slip gauges their description and uses. Polishing, lapping powder and emery clothes lapping flat surface.
11-12	36. Grinding internal bore of cylindrical job and use of telescopic gauge. 37. Preventive maintenance of grinding machines (Surface & Cylindrical).	Grinding defects vibration, chattering, glazing and loading their causes and remedies. Grinding different defects and remedies on its. Applications of diamond wheel in grinding and grinding of tipped tools. Preventive maintenance and its necessity. Mode of frequency of lubrication. Preparation of Maintenance schedule, simple estimation, use of hand book and reference table.
13	**Internal Assessment/Examination 03days**	

NOTE: -

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

BASIC TRAINING (Block – II)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1	38. Cylindrical and surfaces grinding practice (Maintaining parallelism).	Cylindrical grinding machine, its parts, use care and maintenance surface grinding machine-its parts use care and maintenance Universal cylindrical grinding machines parts description use, care and maintenance. Internal grinding machine and its parts their description, use care and maintenance. Combination sets-their use care and maintenance.
2	39. Parallel block grinding on surface grinding machine within close limits. 40. Wheels dressing for rough and finishing grinding.	Bonding materials their kinds description and uses. Grade and structure at grinding wheels. Brief about I.S.O. 9000. Importance of Quality. Specification and types (shapes & size) of grinding wheels. Mounting of grinding wheels, grinding wheels, collets and mandrels.
3	41. Slot grinding practice on surface grinding machines to close limits H7. 42. Finding of different faults while grinding-Cracks, blow holes, chatters.	Dressing and truing of grinding wheels advantage of balancing, inspections and care of grinding wheels. Wheel storage. Gauges-feeler, taper gauge radius, plug, ring snap (fixed and adjustable).
4	43. Grinding practice on parallel and taper pins using chuck and collets-h6.	Special type of grinding machine centreless, thread crankshaft etc. their description, use care and maintenance. Essential mechanism of grinding machines, wheel is guards to IS: 1991-1962 machine guards etc. Process of cleaning and oiling at grinding machines (care and Maintenance) types of steady rests their description and use Types of holding devices methods of holding work, type of centres - holding work between centres types of chucks and holding process in chucks and carburising and its methods, process of carburising (solid, liquid and gas).

5	44. Selection of grinding wheel and grinding practice on rectangular bar of non-ferrous metals.	Holding work on face plate, pneumatic chuck and magnetic chuck. Precautions to taken before grinding, peripheral of surface speed of grinding wheels, importance of constant wheel speeds, calculations at S.F.P.M. Calculation at R.P.M. and S.F.P.M. of grinding wheels calculation of work speed for cylindrical grinding speed and feeds for cylindrical grinding speed and feeds for internal grinding. Traverse and over run of traverse, width of wheel and depth of cut in different types of grinding achiness. Grinding allowance and time estimation. Rough and finish grinding process.
6-7	45. Introduction to CNC machine operation like Jog, Reference Edit, MDI ,Auto Mode 46. Prog. Call & Entry, Tool off-set & Tool changing /Orientation. 47. Compound or double taper grinding practice on cylindrical grinder.	Introduction to CNC Technology CNC M/c. principle advantages classification, drives, controls. Basic information on CNC machine & maintenance of CNC M/c. computer aided CNC Language. Cylindrical-types of cylindrical grinding operation traverse method, plunge cut method and form grinding method. Alignment of head stock and tail stock. Method of plain cylindrical surface grinding step-grinding and shoulder and face grinding. Method of grinding external and angle (simple) taper and steep. Taper double compound taper. Use of universal head for angular grinding. Measuring and checking of taper and angles. Use of taper plug and ring gauges. Taper and angle checking by using protractors, micrometer and rollers.
8	48. Grinding Taper up to close limit H6. 49. Internal step grinding to close limit.	Importance of Technical English terms used in industry –(in simple definition only)Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports,

		job cards Internal centreless grinding methods of holding jobs and processes of grinding. Selection of wheels. Internal grinding work movement and wheel movement. Rotation and reciprocation of job and wheel spindle, Internal grinding allowance, selection of wheels for internal grinding.
9	50. Practice on tools and cutter grinding machine. 51. Lapping practice on flat surface.	Thread grinding method of holding jobs method of grinding threads and thread calculation. Various types of thread grinding wheels and their selection. Laps and lapping material, types of laps lapping abrasives rotary diamond lap lapping lubricants lapping pressures wet and dry lapping. Hand lapping and machine lapping. Lapping flat surface, lapping cylindrical surface.
10-12	52. Form grinding radius angle. 53. Grinding/ re-sharpening of angular cutter by using work head. 54. Slitting saw sharpening practice using tooth rest. 55. Practice sharpening end mill cutter and sharpening tap	Grinding boring tools shaping tools, slotting tools, tools planning and drills, grinding of scrapers, chisels and carbide tipped tools. Selection of wheels fluids etc. and methods of grinding Cutter grinding necessity of sharpening. General method of sharpening milling cutters-clearance angles. Use of setting gauges. Sharpening methods of plain or key way cutters Method of indexing direction of wheel rotation, wheel dressing. Types of cutter grinding wheels and their selection. Types of tooth rests and their location. Grinding peripheral teeth on a side and face milling cutter use of indexing attachment. Calculation of clearance angle. Setting for cup wheels and straight wheels. Recommended clearance angles for different materials to be cut primary and secondary clearance width of lands. Sharpening of helical milling cutter using linear and angular setting methods.

		Sharpening shell end mill and angular cutters Grinding flutes of form cutters, grinding taps, reamers, similar types of cutting tools, use of universal attachment. Hones and honing- Type of honing stones-their description and use. Amount and rate of stock removal. Adjustment for elementary honing condition, honing tolerances.
13	**Internal Assessment/Examination 03days**	

NOTE: -

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

9. 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 viewCircle and its elements.
5.	**Ratio & Proportion** :	- **Constructions: -** Draw proportionate free

	Simple calculation on related problems. **Percentage:** Introduction, Simple calculation.	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
6.	**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.	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 3rd angle projection as per IS specification. - Free hand Drawing of Orthographic projection from isometric/3D view of geometrical blocks

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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, radiation.	**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 symbols**
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	
8.	**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	Basic of computer Networks (using real life examples), Definitions of

Networking and Internet	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

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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 House-keeping, Practice of good Housekeeping.
Quality Tools	Basic quality tools with a few examples.

10. DETAILS OF COMPETENCIES (ON-JOBTRAINING)

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR MACHINIST (GRINDER) TRADE:

1. Safety and best practices /Basic Industrial Culture (5S, KAIZEN, etc.)
2. Record keeping and documentation
3. Making components observing different metal removing procedure and perform different fitting job.
4. Assembling of different components as per requirement and check functionality.
5. Carryout maintenance of different machines including hydraulics & pneumatics system.

Note: Actual training will depend on the existing facilities available in the establishments.

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

Block – I

1. 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 chipping, filing, drilling, counter boring, countersinking, reaming and taping.
4. Types of cutting fluids, their application and inspection e.g. cutting oil concentration, PH value.
5. Interpretation and their effect of various process parameters e.g. feed rate, surface speed, machining time etc.
6. Perform grinding wheel checking, balancing, mounting, dressing, truing and setup automatic movement of table for surface & cylindrical grinder.
7. Set and produce the job with general tolerance on surface and cylindrical grinder.
8. Setup and produce long cylindrical parallel job, taper job, eccentric job, using cylindrical grinder and check for accuracy.
9. Setup and produce internal straight cylindrical parallel job, using internal cylindrical grinder and check for accuracy without any assistance.
10. Perform the grinding of different types of metals such as cast iron, bronze, aluminium, carbide tip and different class of steel by dry and wet grinding method.
11. Setup and produce V- block, cube, parallel bar snap gauge, ring gauge, plug gauge, taper pin to close tolerances and check for accuracy.
12. Perform preventive maintenance of grinding machines.
13. Monitoring of system pressure, abnormal heating, noise and vibrations and action to be taken.
14. Recording of inspection results into control charts (SPC) and understanding of these charts.

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15. Perform thin plate grinding using coolant to close limits within ±0.005 mm.
16. Perform slot grinding on surface grinding machine to close limit (within ±0.005 mm) and check for accuracy without any assistance.
17. Perform different types of bore grinding within accuracy (within ±0.005 mm) and check for accuracy.
18. Interpretation and measurement of different quality aspects e.g. surface finish, diameter and geometric tolerances.
19. Usage of gauges and comparators, specially pneumatic and electronic gauging system.
20. Understand working of tool and cutter grinder, set and resharpen the plain/slot/side and face milling cutter and check for accuracy.
21. Set and resharpen the slitting saw, spiral milling cutter, end mill cutter, angular milling cutter, tap, reamer drill, and check for accuracy.
22. Perform form grinding viz., angular, concave, convex using cylindrical and surface grinder.
23. Perform steep taper, morse taper, lathe centre grinding up to close limit and check for accuracy.
24. Grind different precession components viz. dowel pin, sinebar, slip gauges.
25. Understand working of external and internal centreless grinder and perform different types of grinding operation using through feed, in feed and end feed and check for accuracy.
26. Setting up of centerless grinding for the jobs with different diameter and length and Trouble shooting for grinding defects in centerless grinding e.g. patch marks, spiral marks, chattering marks and taper.
27. Understand working of thread grinding machine tool and perform different types of thread grinding and check for accuracy.
28. Understand working of CNC surface and/or grinder and perform different types of flat job grinding and check for accuracy.
29. Understand working of CNC tool and cutter grinder and perform resharpening of different types of single point tool & milling cutter and check for accuracy. (Optional)
30. Perform basic preventive maintenance of CNC grinding machines.
31. Perform TPM (Total Productive Maintenance), TQM (Total Quality Management) and record keeping system.
32. Heat treat plain carbon steel.
33. Anneal and bend copper pipes to different shapes
34. Handle Jigs and Fixtures
35. Make simple Limit Gauges and Templates
36. Solder and joint ferrous and non ferrous component (soft and hard).
37. Familiarization with pumps, air compressor, pneumatic tools and hydraulic driver machines.

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38. Accuracy testing of Machine tools such as geometrical parameters.
39. Dismantling and mounting of pulleys.
40. Use simple jigs and fixtures for drilling.
41. Dismounting, repairing damaged gears and mounting and check for workability.
42. Repair & replacement of belts and check for workability.
43. Maintenance, troubleshooting, and safety aspects of pneumatic and hydraulic systems (The practical for this component may demonstrated by video)

Note:

- Industry must ensure that above mentioned competencies are achieved by the trainees during their on job training.
- In addition to above competencies/ outcomes industry may impart additional training relevant to the specific industry.

ANNEXURE – I

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

MACHINIST (GRINDER)			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)			
A. TRAINEES TOOL KIT			
Sl. no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
1.	Steel Rule	150mm (graduated both English and Metric).	16 Nos.
2.	Try Square Engineer	150mm	16 Nos.
3.	Outside Calipers (spring)	250mm	16 Nos.
4.	Inside Calipers (spring)	150 mm	16 Nos.
5.	Hammer Ball Peen with handle	0.50 kg.	16 Nos.
6.	Odd leg Caliper	150 mm	16 Nos.
7.	Scriber	150 x 3 mm	16 Nos.
8.	Plier	150 mm	16 Nos.
9.	Goggles	150mm insulated flat type	16 Nos.
B : INSTRUMENTS & GENERAL SHOP OUTFIT			
10.	Hammer	Copper 0.50 kg.	2 Nos.
11.	Hammer Engineers,	Ball Peen 0.50 kg.	2 Nos.
12.	Scribing Block	adjustable Vertical spindle 225 mm 4 Angle Plate, adjustable (graduated in degrees) 150 x 150 x 150 mm	2 Nos.
13.	Blocks Vee	150 x 100 x 100 mm (fitted with clamps, hardened and ground)	2 Pairs.
14.	Blocks Vee	(grooved and fitted with clamps) (Hardened and ground) 75 x 75 x 50 mm	2 Pairs.
15.	Block parallel,	adjustable 150 mm long, 42 mm wide, 18 mm height (hardened and ground)	2 Pairs.

16.	Block, parallel,	adjustable 100 mm long, 50 mm wide, 32 mm height (hardened and ground)	2 pairs.
17.	Calipers, Vernier	200 mm, inside and outside (graduated in inches and millimeters_	1 Each
18.	Calipers, Vernier,	outside 300 mm (graduated in inches and millimeters)	4 Nos.
19.	C-clamps	50 mm, 100 mm and 150 mm	2 Each
20.	Oil can,	Pressure delivery _1/4 point capacity	4 Nos.
21.	Oil can	Drip delivery (long spout) _ point capacity	4 Nos.
22.	Height Gauge	(Metric and English graduated)	1 No.
23.	Combination set	(consisting of 300 mm rule centre)	2 Nos.
24.	Comparator Gauge,	complete with stand and brackets.	2 Nos.
25.	Chuck, Drill	12 mm cap. (Taper shank)	1 No.
26.	Chuck,	Drill 16 mm capacity (Taper shank)	1 No.
27.	Dial Test Indicator	complete with stand (universal type with magnetic base 1/100 mm)	2 Nos.
28.	Diamond, Wheel Dressing	(single stone mounted)	4 Nos.
29.	Files, Hand Flat,	200 mm smooth	8 Nos.
30.	Files, Hand Flat,	250 mm smooth	8 Nos.
31.	Files,	150 mm Half round smooth	8 Nos.
32.	Files,	round Dead smooth 200 mm	4 Nos.
33.	Files,	Triangular, Dead smooth 200 mm and 150 mm	2 Each
34.	Files,	Triangular Dead smooth 150 mm	4 Nos.
35.	File Flat	Rough 300 mm	4 Nos.
36.	File Flat	250 mm Second Cut	4 Nos.
37.	Chisel	Cold Flat 18 mm	4 Nos.
38.	Chisel	Cold Flat 12 mm	4 Nos.
39.	Feeler Gauge	Metric Set	1 set
40.	Gauge Radius	(Inside and Outside) (Metric)	2 Nos.
41.	Gauge,	Slip (Metric) workshop grade	2 Sets
42.	Sine Bar	100 mm and 150mm	1 Each

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43.	Gauge, Telescopic	12 to 150 mm	2 Sets
44.	Gauge,	Morse Taper, Plug Nos. 1,2,3,4	1 Each
45.	Gauge, Morse Taper,	Ring Nos. 1,2,3,4	1 Each
46.	Glass, Magnifying	250 x 25 x 75 mm dia with handle	1 No.
47.	Hacksaw frame	200 to 300 mm adjustable	2 Nos.
48.	Keys, Allen	1 mm to 14 mm by 1 mm	4 Sets
49.	Keys,	Allen 3 to 12 mm, by 1.5 mm	1 Set
50.	Spirit Level,	Engineers 25 mm precision	1 No.
51.	Micrometer outside	0 to 25 mm	3 Nos.
52.	Micrometer outside	25 to 50 mm	2 Nos.
53.	Micrometer outside	50 to 75 mm	1 No.
54.	Micrometer outside	75 to 100 mm	1 No.
55.	Internal Micrometer	25 to 150 mm with extension Rods.	1 No.
56.	Depth Gauge Micrometer	with extension rods to 150 mm with 70 mm Base	1 No.
57.	Indicating Micrometer	0.25 mm range, graduation, 01" mm graduation of dial 0.001 mm range of dial + 0.02	1 No.
58.	Oil Stone Carborandum	Coarse on one side and fine on the other 200 x 50 x 25 mm	2 Nos.
59.	Oil Stone Carborandum,	Coarse on one side and fine on other slip 100 x 12 mm triangular.	2 Nos.
60.	Oil Stone Carborandum,	Coarse on one side and fine on other slip 100 x 18 mm triangular	2 Nos.
61.	Try Square,	Engineer's 100 mm blade	2 Nos.
62.	Straight Edge Engineer's	300 x 50 x 12 mm bevelled edge.	1 No.
63.	Screw Driver	200 mm blade	2 Nos.
64.	Screw Driver	300 mm blade	2 Nos.
65.	Spanner D.E.	open jaw 3 to 18 mm by 3 mm	2 Sets
66.	Scraper Flat	25 x 200 mm with handle	2 Nos.
67.	Scraper Half round	75 x 12 x 200 mm with handle	2 Nos.
68.	Scraper Triangular	62 x 9 x 200 mm with handle	2 Nos.
69.	Techometer	with male and female rubber attachments (upto 0-10,000 RPM)	1 No.
70.	Table Chuck	75 mm Jaw Swivel Base 200 mm	1 No.

		dia. 3 Jaw with bolting arrangement and graduated in degrees	
71.	Vices, Machine Plain	150 Jaws x 100 mm openings	2 Nos.
72.	Vices, Machine,	Swivelling Base 150 mm x 100 mm	2 Nos.
73.	Universal Machine Vice	100 mm for Grinding	2 Nos.
74.	Wheel Dressers,	Steel Type (Huntington) (Large)	2 Nos.
75.	Wheel Dressers,	Steel (Huntington type Small)	3 Nos.
76.	Radius Truing Attachment	for surface grinding machine	1 No.
77.	Radius Truing Attachment	for cylindrical grinding machine.	1 No.
78.	Angle Truing Attachment	for surface grinding machine.	1 No.
79.	Demagnetizer Chuck		1 No.
80.	Centre Punch	150 x 6 mm dia	4 Nos.
81.	Reamer	Adjustable 6 to 16 x 1.5 mm	1 Set
82.	Surface Plate	60 x 60 cms	1 No.
83.	Marking Table	90 x 60 x 90 cms	1 No.
84.	Hand Drill	6 mm	1 Set
85.	Taps and Dies	complete set in box (Metric)	1 Set
86.	Taps and Dies	set B.A.B.S.F.B.S.W. and American	1 Set
87.	Drill Twist	(Straight Shank) 1/8" to 1/2" by 1/64"	1 Set
88.	Drill Twist	(Metric) 3 mm to 12 mm, in step of 1 mm	1 Set
89.	Set of Sockets	Morse taper (0-1, 1-2 and 2-3)	1 Set
90.	Drill Chuck	0 to 12 mm Morse Taper	1 No.
91.	Combination	Drill (Centering)	2 Nos.
92.	Screw Pitch Gauge		2 Nos.
93.	Working Benches	340 x 120 x 75 cms with 4 bench vices, 125 mm jaw	1 No.
94.	Fire Extinguisher		1 No.
95.	Fire Buckets with stand		4 Nos.
96.	Steel lockers	with 6 drawers	2 Nos.
97.	Metal Rack	180 x 150 x 45 cms	1 No.

MACHINIST (GRINDER)

98.	Desk		1 No.
99.	Stool		1 No.
100.	Black Board with Easel		1 No.
101.	Magnifying Glass with surface illuminator		1 No.
102.	CMTI surface finish standards (in Bakelite)		1 No.
103.	Adjustable Wrench	250 mm size	1 No.
104.	Hammer	(Nylon face) 30 mm	4 Nos.
105.	Grease Gun		2 Nos.
106.	Magnetic V-Block	with push button switch	1 Set
107.	Magnetic V-Block	base for Dial Indicator 75 x 75 x 100 mm	2 Nos.
108.	Diamond Dresser	Cluster type	2 Nos.
109.	Adjustable Parallel Clamps	(Hardened and ground) 100 mm long	2 Pairs
110.	Granite Stone Surface Plate	Grade A 600 x 500 x 1000 mm	1 No.
111.	Static balancing stand	for grinding wheel	1 No.
112.	Soft Board for display	1.25 mm x 1.85 mm x 10 mm thick	1 No.
113.	Dial Test Indicator-	Lever type-long point	2 Nos.
114.	Magnetic Stand	Flexible type base 60 mm x 47.5 mm Magnetic Power 75 kg. ON-OFF Lever control	2 Nos.
115.	Cutter Clearance Gauge	to Suit Clearance all cutter diameters angle 0"-30".	1 Set
116.	Glass Show Case for display of jobs	450 mm x 600 x 850mm	1 No.
Desirable:-			
117.	Shadeograph projector with diascopic and epidiascopic projection	Magnification 50, 100, 200, rotary screen 1 minute accuracy and centering, attachment.	1
C : GENERAL MACHINERY INSTALLATIONS			
118.	Lathe	75 cm between centers x 180 cm centre height 4 jaw independent chuck, self centering chuck set of lathe tools, lathe carriers etc. complete	2 Nos.
119.	Drilling machine pillar	0-12 capacity	1 No.
120.	Grinding machine external cylindrical	fully motorized and supplied with face plates and driving dogs, 3-jaw self centering chuck	2 Nos.

		4- jaw independent chuck tail stock assorted centers, stud pumps tank allguards and pipe fittings spanners and grease gun (each machine to be supplied with assorted grinding wheels and tool grinding machine for general purpose work with internal grinding attachment)	
121.	Grinding machine plain surface,	with horizontalspindle wheel dia. 175 mm (or near) with reciprocating table having longitudinal table traverse 200 mm (or near) fully automatic and fitted with adjustable traverse steps, machine to be fully motorized and fitted with ace guards and pumps, tank and pump fittings and also to be supplied with magnetic chuck 250 x 112 mm. Diamond tool holder, set of spanners, grease gun, oil-can and spare grinding wheel for general purpose grinding.	2 Nos.
122.	Grinding machine plain surface	vertical spindle, reciprocating table having longitudinal table traverse fully motorized and supplied with set of spanners, necessary equipment, diamond tool holders for wheel sized 175 x 30 x 18 mm suitable cup wheels for vertical spindle, spare wheel proper guards and coolant pump with fittings.	2 Nos.
123.	Tool and cutter grinding machine	size 250 x 375 mm fully motorized supplied with chuck, centers tool rest, height gauge, table clamps universal vice tooth rest. Diamond dressing tool and holding attachment equipment for tool grinding and assorted grinding wheels for all tool room work (with twist drill grinding	2 Nos.

		attachment).	
124.	Lapping machine	with motor and chuck 132 cm dia.	1 No.
125.	Grinding machine universal,	machine to be motorized and supplied with assorted arbors spindles for internal work, 3-jaw self centering chuck, 4-jaw independent chuck face plate driving dogs, tail stock and centers, machine to be completed with all guards, sud and driving dogs, 3-jaw self centering chuck pump and tank, pipe fittings, diamond tool holder fixtures, radius dressing attachment and with spanners (internal and external) and general purpose grinding cylindrical magnetic chuck (permanent) 2,000 mm dia.	2 No.
126.	Small type hand honing machine	with motors sand and bracket and with sets of different types of honing stones and other accessories.	1 No.
127.	Lathe machine	with taper turning attachment 4-jaw chuck and 3-jaw chuck.	1 No.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: MACHINIST (GRINDER)
LIST OF TOOLS& EQUIPMENTS FOR -20APPRENTICES

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

2) Infrastructure:

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

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

ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor :												**Year of Enrollment :**		
Name & Address of ITI (Govt./Pvt.) :												**Date of Assessment :**		
Name & Address of the Industry :												**Assessment location: Industry / ITI**		
Trade Name :		**Semester:**										**Duration of the Trade/course:**		
Learning Outcome:														
Sl. No	**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														