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

COMPETENCY BASED CURRICULUM

GRINDER (OF)

(Duration: 1200 hrs.)

FLEXI MoU SCHEME

NSQF Level 4

Sector – Capital Goods & Manufacturing

Directorate General of Training

GRINDER (OF)

FLEXI MoU SCHEME

(Designed in 2020)

Version: 1.0

NSQF LEVEL - 4

Developed By

Ministry of Defense

Directorate General of Ordnance Factories

ORDNANCE FACTORY BOARD

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Ministry of Skill Development and Entrepreneurship

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1. COURSE INFORMATION

During the 8 months' (40 Weeks) duration a candidate is trained on subjects Professional Skill, Professional Knowledge & Engineering Drawing. The practical skills are imparted in simple to complex manner to understand the operations & simultaneously basic theory subject is taught to understand the terminology and definition of the topics while executing tasks.

The trainees will be imparted safety aspects which covers components like use of PPs, Fire extinguishers, First Aid, OSH&E. In addition, trainees will be imparted knowledge of 5S and safely use of Tools and equipment's. The practical part starts with basic fitting to the complex operations in grinding. The topics covered under this course are filing, chipping, drilling, turning, measurement, Surface Grinding, Cylindrical Grinding, Tools & cutter grinding, lapping & honing, etc. etc.

The course element of employability skills, library & extracurricular activities, project work and revision has not been considered in this course being as trainees are NCVT complied Govt. Servants and course is meant to re-skill the working employees to other engineering trades.

2. TRAINING SYSTEM

2.1 GENERAL

OFB is a giant industrial setup which functions under the Department of Defence Production of the Ministry of Defence Mission of OFB is Production of State of the Art Battle Field Equipment. It needs large number of skilled resources in various fields. With the changing need of the armed forces there is shift in production requirements because of which there is a pressing need for re-skilling of employees working in the tailoring and other trades.

Flexible Memorandum of Understanding or Flexi-MoU scheme, a pioneer program of DGT, is designed to cater to the needs of both industry as well as trainee, allowing industries to train candidates as per their skill set requirements and providing trainees with an industry environment aligned with the market demand and latest technology to undergo training. The scheme gives the industry the flexibility to create tailored skilling programs with customized courses, having content and curriculum that is market relevant and meets the industry requirements.

Candidates broadly 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 while performing jobs.
- 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 PROGRESSION PATHWAYS:

Training is imparted to re-skill the employees in other trades to make them align with the changing demands. The carrier progression will be as : -

Semi-Skilled (SS) > Skilled (SK) > High Skilled-II (HS-II) > High Skilled-I (HS-I) > Master Craftsman (MCM).

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2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements: -

S No.	Course Element	Proposed hours
1	Professional Skill (Trade Practical)	**900**
2	Professional Knowledge (Trade Theory)	**220**
3	Workshop Calculation & Science	**40**
4	Engineering Drawing	**40**
	Total	**1200**
	NOTE : Employability subject is exempted as entrants are NCVT qualified Govt Employees	

2.4 ASSESSMENT & CERTIFICATION:

The training will be tested for skill and knowledge during the period of course. There will be internal assessment in every two months conducted by faculty/trainer for the course element covered during the period.

The final assessment will be in the form of summative assessment method. The Trade Test for awarding NCVT equivalent certification will be conducted by Controller of examinations, DGT as per the guidelines. The pattern and marking structure are being notified by DGT from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment in accordance with above course elements. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percentage for practical is 60% & minimum pass percentage of theory subjects is 33%. There will be no Grace marks.

2.4.2 ASSESSMENT GUIDELINE

Assessment will be evidence based comprising the following:

- Job carried out in workshop
- Record book/Daily Diary maintained by trainee and countersigned by Trainer.
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality

Evidences and records of internal assessments are to be preserved until forthcoming examination for audit and verification by examination body.

3. JOB ROLE

Grinder General: - grinds and smoothens metal surfaces to specified accuracy using one or more type of grinding machine. Examines drawings and other specifications of part to be ground. Selects grinding wheel of appropriate size, shape and abrasive quality and fastens it on spindle of machine. Mounts metal part accurately in position on machine using chucks, jigs, fixtures or between centers of head and tail stock of machine as required and sets it accurately either parallel or at angle in relation to grinding wheel as specified using appropriate devices and instruments necessary. Adjusts machine table, guides, stops and other controls to determine direction and limit of metal and grinding wheel movements. Selects grinding wheel speed and starts machine for grinding. Manipulates hand wheel or sets and starts automatic controls to bring grinding wheel in contact with work. Checks progress of grinding with measuring instruments and gauges for accuracy. May balance dress or change grinding wheel, stone or abrasive. May oil and clean machine.

Surface Grinder: - grinds flat surfaces of machined metal objects to required finish and thickness by surface grinding machine. Studies drawings and other specifications for nature of grinding operations required. Selects appropriate grinding wheel and fits it on machine spindle. Places work in position on magnetic chuck on the machine. Sets required speed of grinding wheel and feed of machine and adjust guides and stops to control to and fro travel of machine table. Starts machine and brings grinding wheel into contact with work. Applies cut and observes progress of operation. Stops machine and measure work as necessary to ensure required accuracy. Removes work from machine when grinding completed. May operate horizontal or vertical spindle surface grinding machine. May oil and clean machine.

Roll Grinder: - grinds shafts, rollers, commutator etc., to

finish for various mechanical purposes by centerless, cylindrical or universal grinding machine. Studies drawing and other specifications of parts to be ground. Selects and mounts appropriate abrasive wheels on machine. Turns hand wheel to adjust gap between rims of wheels according to diameter of part to be ground. Moves levers to select appropriate speeds for each wheel. Sets feed guide to guide work into position between two-wheel rims and clamps coil guide properly to receive work from between wheel rims. Starts machine and feeds work on to feed guide or keeps hopper filled with objects that are automatically fed between wheels. Observes progress of work and checks periodically ground parts with micrometre or gauge to ensure that they conform to prescribed specifications. May do cylindrical grinding of parallel, step and taper shafts and internal bores set between centres or otherwise by processes of traverse plunge or angular grinding and be designated as CYLINDRICAL GRINDER or INTERNAL GRINDER as appropriate. May set or adjust grinding wheel distance for different operations. May clean and oil machine.

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Honer/Honing Machine Operator: - Honer grinds internal surface of bores and cylinders to accurate mirror like finish with honing machine. Mounts ground cylinder accurately in position on machine, using clamps, jigs and other fixtures. Selects appropriate honing stick (abrasive tool) and clamps it on spindle of machine. Aligns cylinder accurately so that honing tool goes smoothly inside cylinder bore. Sets machine to feed and rotate hone at appropriate speed and starts machine. Expands tool to required diameter and manipulates hand wheel to feed tool into cylinder. Engages automatic feed that oscillates hone within cylinder and regulates supply of cutting lubricant over honing tool. Checks progress of honing as required with measuring instruments and makes necessary adjustments to ensure accuracy. Removes work when honing is completed. May do internal grinding of cylinders and bores. May oil and clean machine.

Lapper: -smoothens hardened flat, cylindrical, spherical or other metal surfaces mechanically or manually to glossy finish by rubbing surfaces with fine abrasives. Examines drawings and other specifications of part to be lapped and selects appropriate abrasive dust. Fits lapping wheel and sets object to be lapped on machine. Applies abrasive dust on metal surface and wheel and starts machine. Brings metal objects in contact with lapping wheel or holds work by hand over lapping wheel and polishes surface to required finish. Applies abrasive compound where necessary to attain high degree of finish. Smoothens or polishes surface for set period. Removes metal and cleans it in special liquids. May do hand lapping by enclosing object in container and vigorously rubbing by hand top plate of container with abrasive compound on metal surface to attain high degree of polish and accurate finish.

Reference NCO:2015

(i) 7224.0100 – Grinder, General
(ii) 7224.0400 - Surface Grinder
(iii) 7224.0300 – Roll Grinder
(iv) 7224.0600 – Honer / Honing Machine Operator
(v) 7224.0700 – Lapper

4. GENERAL INFORMATION

Name of the Trade	**GRINDER (OF)**
Trade Code	DGT/7015
NSQF Level	Level – 4
Duration of Craftsmen Training	1200 Hours
Entry Qualification	NCVT qualified Govt Employees.
Minimum Age	18 years as on first day of academic session.
Eligibility for PwD	N/A
Unit Strength (No. Of Student)	20
Space Norms	102 Sq.m
Power Norms	23.4 KW
Instructors Qualification for	
1. Grinder (OF) Trade Workshop Calculation & Science and Engineering Drawing	B.E./B.Tech/B.Voc. Degree in Mechanical Engineering from recognized Engineering College/ university **OR** 03 years Diploma in Mechanical Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT. ***Note- Trainer should have minimum 3-4 years' experience in the field of Engg. production.***
2. Minimum Age for Instructor	21 Years
List of Tools and Equipment	As per Annexure – I

5. LEARNING OUTCOME

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

5.1 LEARNING OUTCOMES

1. Observe safety and know the use of personal protection and fire safety equipment.
2. Plan and organize the work to make job as per specification applying different types of basic fitting operation and check for dimensional accuracy by using steel rule, caliper etc. following safety precautions.
3. Produce simple components by setting different machine parameters and performing different lathe operation [Different machine parameters: - Cutting, speed, feed, depth of cut; Different lathe operation – Facing, plain turning, taper turning, boring and simple thread cutting.]
4. Perform grinding wheel mounting, balancing, dressing, truing and set surface grinder to make job by rough & finish grinding and check accuracy with precision measuring instrument [Accuracy limit:- ±0.25mm.]
5. Set cylindrical grinder to produce job/ components by performing external and internal cylindrical operation and check accuracy [Accuracy limit:- ±0.25mm.]
6. Set up cylindrical grinder for automatic movement to perform different cylindrical grinding operation using different machine accessories and check accuracy [Different cylindrical grinding:- straight parallel, taper, bush eccentric; Different machine accessories: - steady rest, chuck face plate, angle plate and check accuracy limit ±0.02 mm]
7. Perform dry & wet grinding to make different shaped job of various metals and check accuracy. [Different shaped job: - square block angle plate, angular block; various metal: - cast iron, steel & accuracy limit ±0.02 mm.]
8. Make a component by performing bore grinding and check accuracy by telescopic gauge. [Accuracy limit ±0.02 mm.]
9. Perform re-sharpening of different tools on pedestal grinder. [Different tools: - lathe tools, drill, tool bit]
10. Make components having angular and straight surface and check accuracy with different gauges and instruments. [Different components: - V' block, parallel bar, drill point angle; Different gauges: - sine bar, slip gauge & DTI (dial test indicator) and accuracy limit ±0.02 mm.]
11. Perform preventive maintenance of grinding machines[Grinding machines: - surface and cylindrical]

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12. Make job of different material by cylindrical parallel grinding with appropriate accuracy. . [Different material: - soft & hard metals; Accuracy limit±0.01mm]
13. Perform operations on tools & cutter grinder and re-sharpening of different milling cutters
14. Make different components having straight & angular surface with close tolerance limit and check different fault.
15. Make different gauges with close tolerance limit and check accuracy with different gauges. [Different gauges: - snap gauge, ring gauge; tolerance limit- (H7/h7); Checking gauges- ring, plug]
16. Produce different components of non-ferrous metal within appropriate accuracy. [Different components - taper pin, rectangular bar; accuracy limit- ±0.01mm.]
17. Produce different components involving cylindrical angular grinding operation to close limit accuracy [Different components- lathe centre, milling machine arbor; accuracy:- h6 or H6]
18. Prepare surface of a component by honing operation & Check accuracy. [Accuracy limit: ±0.001mm]
19. Produce components by different taper grinding operation and check accuracy. [Different taper grinding: - compound or double taper, steep taper, morse taper; accuracy limit- ±0.008mm.]
20. Produce male and female components by different grinding to close tolerance limit. [Different grinding: - step and slot grinding; tolerance limit- H6/h5]
21. Prepare surface of a job by performing lapping & buffing to close limit h5.
22. Make components by different grinding to close tolerance limit and check accuracy. [Different grinding: - cylindrical taper, surface grinding & shoulder grinding; tolerance limit- h6]

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Observe safety and know the use of personal protection and fire safety equipment.	Explain disposal procedure of waste materials
	Explain Safety signs for Danger & caution
	Demonstrate use of Fire extinguishers
2. Plan and organize the work to make job as per specification applying different types of basic fitting operation and check for dimensional accuracy by using steel rule, caliper etc. following safety precautions.	Plan & identify tools, instruments and equipments for marking and make this available for use in a timely manner.
	Select raw material and visual inspection for defects.
	Measure all dimensions in accordance with standard specifications and tolerances.
	Identify hand tools for different fitting operations and make these available for use in a timely manner.
	Prepare the job for Hacksawing, chiselling, filing, drilling, tapping, grinding.
	Perform basic fitting operations to close tolerance as per specification to make the job.
	Observe safety procedure during above operation as per standard norms and company guidelines.
	Check for dimensional accuracy as per standard procedure.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
3. Produce simple components by setting different machine parameters and performing different lathe operation [Different machine parameters: - Cutting, speed, feed, depth of cut; Different lathe operation – Facing, plain turning, taper turning,	Identify and acquaint with lathe machine operation with its components.
	Identify different work holding devices and acquaint with functional application of each device.
	Mount the appropriate work holding device and check for its functional usage to perform turning operations.
	Set the job on chuck as per shape.
	Set the lathe on appropriate speed & feed.
	Operate the lathe to demonstrate lathe operation, observing

boring and simple thread cutting.]	standard operating practice.
	Perform lathe operation to make components as per specification.
	Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement.
	Observe safety procedure during above operation as per standard norms and company guidelines.
4. Perform grinding wheel mounting, balancing, dressing, truing and set surface grinder to make job by rough & finish grinding and check accuracy with precision measuring instrument [Accuracy limit:- ±0.25mm.]	Acquaintance of basic working principles and safety aspect of grinding wheel mounting, balancing, dressing and truing of grinding wheel.
	Explain functional application of different levers, stoppers, adjustment etc. for surface grinder.
	Identify different lubrication points of surface grinder.
	Identify lubricants and their usage for application in surface grinder as for machine manual.
	Identify different grinding wheel mounting devices and acquaint with functional application of each device.
	Mount the grinding wheel with required alignment and check for its functional usage to perform surface grinding operations.
	Observe safety procedure during wheel and job mounting as per standard norms
	Plan & select appropriate method to produce different operation rough & finish.
	Check accuracy of job using appropriate measuring instrument.
5. Set cylindrical grinder to produce job/ components by performing external and internal cylindrical operation and check accuracy [Accuracy limit:- ±0.25mm.]	Explain the constructional features, working principles and safety aspect of cylindrical grinder.
	Explain functional application of different levers, stoppers, adjustment etc.
	Identify different lubrication points of cylindrical grinder.
	Identify lubricants and their usage for application in cylindrical grinder as per machine manual.
	Identify different work and tool holding devices and acquaint with functional application of each device.

	Mount the work and tool holding devices with required alignment and check for its functional usage to perform cylindrical grinding operations.
	Observe safety procedure during mounting as per standard norms
	Plan & select appropriate method to grind external & internal operation
	Check accuracy of job using appropriate precision measuring instrument.
6. Set up cylindrical grinder for automatic movement to perform different cylindrical grinding operation using different machine accessories and check accuracy [Different cylindrical grinding:- straight parallel, taper, bush eccentric; Different machine accessories: - steady rest, chuck face plate, angle plate and check accuracy limit ±0.02 mm]	Plan & select appropriate machine parameters to set for automatic movements
	Carryout and apply standard method to make different components as required.
	Set up and produce component as per standard operating procedure for form grinding.
	Check accuracy of job using appropriate precision measuring instrument.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
7. Perform dry & wet grinding to make different shaped job of various metals and check accuracy. [Different shaped job: - square block angle plate, angular block; various metal: - cast iron, steel & accuracy limit ±0.02 mm.]	Identify different work material and select the grinding wheel.
	Observe heat generated in grinding for different types of metal.
	Select appropriate coolant for different types of metal grinding.
	Observe safety procedure during operation as per standard norms.
8. Make a component by performing bore grinding and check accuracy by telescopic gauge. [Accuracy limit ±0.02 mm.]	Plan and select appropriate method to produce components.
	Set up and produce component with bore as per standard Operating procedure of internal cylindrical grinding.
	Measure the dimensions with instruments/gauges as per drawing.

	Comply with safety rules when performing the above operations.
9. Perform re-sharpening different tools on pedestal grinder. [Different tools: - lathe tools, drill, tool bit]	Plan and select appropriate method to re-sharpen the lathe tools, drill bit.
	Dress the grinding wheel and set the tool.
	Work out and apply off-grinding parameters as per different components to be re sharpened.
	Set and re-sharpen the tools as per standard operating procedure
	Solve problems during operation by selecting and applying basic methods, tools, material, collect and organize information for quality output.
	Comply with safety rules when performing the above operations.
10. Make components having angular and straight surface and check accuracy with different gauges and instruments. [Different components: - V' block, parallel bar, drill point angle; Different gauges: - sine bar, slip gauge & DTI (dial test indicator) and accuracy limit ±0.02 mm.]	Plan and select appropriate method to produce various components with the help of surface grinder.
	Select the appropriate grinding wheel and work holding devices.
	Produce components as per drawing.
	Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement.
	Comply with safety rules when performing the above operations.
11. Perform preventive maintenance of grinding machines. [Grinding machines: - surface and cylindrical]	Identify tools & equipment and collect relevant information from appropriate source.
	Ascertain for the aligning / parallelism of grinding machines.
	Plan work for lubrication schedule, simple estimation.
	Observe mechanism, driving system of grinding machines and set properly if required.
	Observe safety procedure during operation as per standard norms.

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12. Make job of different material by cylindrical parallel grinding with appropriate accuracy. [Different material: - soft & hard metals; Accuracy limit±0.01mm]	Plan and select appropriate method to produce various components with the help of cylindrical grinder.
	Select the appropriate grinding wheel according to material to be ground and work holding devices.
	Produce components as per drawing.
	Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement.
	Observe safety procedure during operation as per standard norms.
13. Perform operations on tools & cutter grinder and re-sharpening of different milling cutters	Plan and select appropriate method to re-sharpen the plain, side and face milling cutter.
	Set up milling cutter and re-sharpen the milling cutter as per standard operating procedure of the machine.
	Measure the dimensions with instruments/gauges.
	Comply with safety rules when performing the above operations.
14. Make different components having straight & angular surface with close tolerance limit and check different fault.	Plan and select appropriate method to produce various components with the help of surface grinder and cylindrical grinder.
	Select the appropriate grinding wheel and work holding devices.
	Produce components as per drawing.
	Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement.
	Observe safety procedure during operation as per standard norms.
15. Make different gauges with close tolerance limit and check accuracy with different gauges. [Different gauges: - snap gauge, ring gauge; tolerance limit- (H7/h7); Checking gauges- ring, plug]	Plan and select appropriate method to produce various components with the help of surface grinder and cylindrical grinder.
	Select the appropriate grinding wheel and work holding devices.
	Produce components as per drawing.
	Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement.
	Comply with safety rules when performing the above

	operations.
16. Produce different components of non-ferrous metal within appropriate accuracy. [Different components - taper pin, rectangular bar; accuracy limit- ±0.01mm.]	Plan and select appropriate method to perform the precession components of nonferrous viz. dowel pin, rectangular bar.
	Set and produce the precession components as per drawing.
	Check for accuracy of the precession components.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
	Observe safety/ precaution during machining.
17. Produce different components involving cylindrical angular grinding operation to close limit accuracy. [Different components- lathe centre, milling machine arbor; accuracy:- h6 or H6]	Plan and select appropriate method to perform lathe center, milling machine arbor grinding.
	Set up and produce component as per standard operating procedure of lathe center, milling machine arbor grinding.
	Measure with instruments/gauges as per drawing and check functionality of component.
	Comply with safety rules when performing the above operations.
18. Prepare surface of a component by honing operation & Check accuracy. [Accuracy limit: ±0.001mm]	Plan and select appropriate method to finish the work piece by honing as per drawing.
	Select appropriate tools, equipment and machine to produce the work piece as per drawing and make these available for use in a timely manner.
	Honed the work piece as per standard operating practice.
	Check the dimension of job by precession instrument.
	Observe safety precautions during operation.
	Check for desired performance.
19. Produce components by different taper grinding operation and check accuracy. [Different taper grinding: - compound or	Plan and select appropriate method to produce the various taper work piece as per drawing.
	Set up and produce component as per standard operating procedure of taper grinding.
	Measure with instruments/gauges as per drawing and check

double taper, steep taper, morse taper; accuracy limit- ±0.008mm.]	functionality of component.
	Comply with safety rules when performing the above operations.
20. Produce male and female components by different grinding to close tolerance limit. [Different grinding: - step and slot grinding; tolerance limit- H6/h5]	Plan and select appropriate method to produce male female components as per drawing.
	Select appropriate grinding wheel, equipment and machine to produce the work pieces as per drawing and make these available for use in a timely manner.
	Set the job on grinding machine and grind the components as per specification/drawing following Standard operating practice.
	Check the dimension of components by precession instrument.
	Observe safety precautions during operation.
	Check for desired performance of assembled components.
21. Prepare surface of a job by performing lapping & buffing to close limit h5.	Plan and select appropriate method to produce the work piece as per drawing.
	Select appropriate tools, equipment and machine to produce the work piece as per drawing and make these available for use in a timely manner.
	Lapping/buffing the product following standard operating practice.
	Set the job and finish the surfaces as per specification/drawing following standard operating practice.
	Check the dimension of job by precession instrument.
	Observe safety precautions during operation.
22. Make components by different grinding to close tolerance limit and check accuracy. [Different grinding: - cylindrical taper, surface grinding & shoulder grinding; tolerance limit- h6]	Plan and select appropriate method to produce the work piece with close tolerance as per drawing.
	Set the job on grinding machine and grind the components as per specification/drawing following Standard operating practice.
	Check the dimension of components by precession instrument.
	Dispose waste as per procedure.
	Observe safety precautions during operation.

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Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skills – 20 Hrs Professional Knowledge – 05 Hrs	Observe safety and know the use of personal protection and fire safety equipment.	Importance of trade training List of tools & Machinery used in the trade Health & Safety: Introduction to safety equipment and their uses Introduction of First-aid Operation of Electrical mains Occupational Safety Health Importance of housekeeping & good shop floor practices Safety and Environment guidelines Legislations & regulations as applicable Disposal procedure of waste materials like cotton waste, metal chips/burrs etc Basic safety introduction Personal protective Equipment (PPE):- Basic injury prevention 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 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 Industrial Training Institute system including stores procedures. **Soft Skills: its importance and Job area after completion of training.** Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies eg; power failure, fire, and system failure. Introduction to Grinding trade and machine safety precautions according to IS: 1991-1962.
Professional Skills – 60 Hrs Professional Knowledge – 15 Hrs	Plan and organize the work to make job as per specification applying different	Identify of tools & equipment as per desired specifications for marking & sawing (Hand tools, Fitting tools & Measuring tools)	Description of hand tools, Safety precautions, care and maintenance and material from which they are made

	types of basic fitting operation and check for dimensional accuracy by using steel rule, caliper etc. [Basic Fitting operation- marking, hack sawing, chiselling, filing, drilling, reaming, taping, off-hand grinding etc. accuracy±0.25mm]	Select material as per application, Inspect visually of raw material for rusting, scaling, corrosion etc Mark out lines on job, Grip suitably in vice, Cut different types of metals of different sections to given dimensions by a Hacksaw Mark, punch and grind on pedestal grinder Measure different types of jobs by steel rule, caliper etc. and put dimension on freehand drawing Taper by angular protractor Drill different sizes of holes by hand, Ream the holes, Make thread in drilled holes by tap Prepare thread on a round bar Match an internal and external thread cutting with taps and dies using coolants Drill different sizes of holes by machine Use of screw drivers, spanners, pliers etc Make simple fitting job within accuracy ±04 File a MS flat as given dimension, Make simple fitting job within accuracy ±02	Ferrous and nonferrous metal and their identification by different methods. Heat treatment of metals, its importance, various methods of heat treatment such as hardening, tempering, normalizing, annealing etc. Theory of Semi precision measuring instruments. General measuring tools (used in grinding shop) their description, use care and maintenance. Relation between drill & tap sizes, care of taps and dies and their correct use. Types, properties and selection of coolants and lubricants. Brief description of drilling machine use and care. Knowledge of tool fixing and job holding device on drilling machine. Knowledge of different types of files according to cut and shape. Methods of filing operation. Knowledge of surface finish accuracy by filing.

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Professional Skills – 40 Hrs **Professional Knowledge – 10 Hrs**	Produce simple components by setting different machine parameters and performing different lathe operation [Different machine parameters: - Cutting, speed, feed, depth of cut; Different lathe operation – Facing, plain turning, taper turning, boring and simple thread cutting.]	Identify Centre lathe and its parts Set lathe machine and perform on lathe operation with idle or dry run Grind Lathe Tools on Pedestal Grinder Perform facing and turning on lathe Perform drilling operation on lathe Perform simple external screw cutting Perform simple internal screw cutting	Brief description of a Centre lathe, its use. Knowledge of transmission of speed from motor to spindle of a lathe. Knowledge of aligning a job on lathe. Lathe tools nomenclature. Knowledge of controlling cutting speed, feed and depth of cut. Lathe tools and their uses. Selection of tools for different operation in lathe. Taper and its types and problems. Taper turning methods and calculations. i.e. Form tool, TT attachment, Compound rest etc. Method of screw cutting and simple calculation. Knowledge of spindle speed mechanism related to lead screw of lathe.
Professional Skills – 40 Hrs **Professional Knowledge – 10Hrs**	Perform grinding wheel mounting, balancing, dressing, truing and set surface grinder to make job by rough & finish grinding and check accuracy with precision measuring instrument [Accuracy limit:- ±0.25mm.]	Set grinding wheel on wheel flange, truing and balancing of wheels Dress grinding wheel Check and measure various types of jobs using micrometre, Vernier calliper, Height gauge etc Identify different parts of surface grinding machine Set surface grinding machine and perform operating with dry / idle run Perform rough and finish grinding on surface work Perform grinding on surface grinding machine Perform rough and finish grinding on	Application and use of pedestal grinder. General dressing tools used in grinding section such as wheel, diamond dresser, steel type dresser, abrasive dresser and nonferrous dresser. Precision measuring instruments English and metric micrometre, vernier calliper, dial test indicator etc. their description and uses. Knowledge of digital measuring instruments and its uses. Pneumatic gauges – its

		cylindrical job Include diamond and CBN grinding wheel Grind parallel block within accuracy ±0 2mm	accessories and control device and use for checking dimensions. Different types of abrasive, manufacture of grinding wheels, their grades.
Professional Skills – 45 Hrs **Professional Knowledge – 10 Hrs**	Set cylindrical grinder to produce job/ components by performing external and internal cylindrical operation and check accuracy [Accuracy limit:- ±0.25mm.]	Identify different parts of cylindrical grinding machine Set cylindrical grinding machine and perform operation with dry / idle run Perform grinding on Cylindrical grinding machine (Grinding should be performed both on soft and hardened materials) Demonstrate selection of grinding wheels for grinding different metal. Select of suitable wheel to obtain rough and IS: 1249-1958 Grind different metals with suitable grinding wheels Perform externals cylindrical grinding operation within 1mm Perform internal cylindrical grinding operation within accuracy ± 01mm Change the recommended wheel speed and control	Principle and value of grinding in finishing process, various types of grinding wheels their construction and characteristic glazed and loaded wheels. Knowledge how to square up a workpiece using an angle plate. Checking of squareness. Multiple clamping of parts to achieve concentricity & uniformity in size. Factors effecting selection of wheels, identification of wheel, marking system of grinding wheels IS: 551-1966. Grit and different types of bonds, such as vitrified, resinoid, rubber etc. Different types of metals and electroplated bond. Grinding wheel speed, surface speed per minute conversion of peripheral

		depth of cut Perform grinding of sockets both internal and external and check Perform Morse taper grinding both internal and external and check Perform grinding External sleeve and check Perform depth checking by depth gauge micrometer	speed to r.p.m. Depth of cut and range at usefulness. Depth micrometer and vernier caliper. Common types of surface grinding machine, plain surface, rotary surface, horizontal and vertical
Professional Skills – 65 Hrs Professional Knowledge – 15 Hrs	Set up cylindrical grinder for automatic movement to perform different cylindrical grinding operation using different machine accessories and check accuracy [Different cylindrical grinding:- straight parallel, taper, bush eccentric; Different machine accessories: - steady rest, chuck face plate, angle plate and check accuracy limit ±0.02 mm]	Test and mount wheels, sleeves, check truing and rebalancing Perform grinding parallel mandrel within ± 03mm Perform wheel balance and dressing grinding long bar using steady rest Perform grinding different types of jobs using machine chuck, face angle plate collets Align table with the help of test bar and dial test indicator Perform parallel grinding within accuracy ±02mm Perform cylindrical Taper grinding (by swiveling machine table) Grind an eccentric job Finish different types of jobs using jigs and fixtures, angle plates by grinding Perform grinding of job by using face plate angle plate etc Finish surfaces of bushes on mandrel within ±02 mm by grinding	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. 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. 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.
Professional Skills – 40 Hrs **Professional Knowledge – 10 Hrs**	Perform dry & wet grinding to make different shaped job of various metals and check accuracy. [Different shaped job: - square block angle plate, angular block; various metal: - cast iron, steel & accuracy limit ±0.02 mm.]	Perform dry and wet grinding of different classes of metals such as cast iron, brazed carbide tip and different classes of steel Grind square block within accuracy ±02mm Grind angle plate within accuracy ±02mm Grind angular block within accuracy ±02mm	Heat generated in grinding dry and wet grinding use of coolant, their composition and selection. Characteristic of coolant. Grinding a square job grinding angular surface taker grinding by stane land taper and angle
Professional Skills – 20 Hrs **Professional Knowledge – 05 Hrs**	Make a component by performing bore grinding and check accuracy by telescopic gauge. [Accuracy limit ±0.02 mm.]	Perform bore grinding within accuracy ±02mm Use of Telescopic gauge for checking of bore	Grinding defects vibration, chattering, glazing and loading their causes and remedies.

GRINDER (OF)

Professional Skills – 20 Hrs Professional Knowledge – 05 Hrs	Perform resharpening of different tools on pedestal grinder. [Different tools: - lathe tools, drill, tool bit]	Mount wheel and guards on pedestal grinder Sharpen lathe tools on pedestal grinder Sharpen drill, tool-bit on pedestal grinder	pedestal grinder and bench grinder-their description and uses.
Professional Skills – 60 Hrs Professional Knowledge – 15 Hrs	Make components having angular and straight surface and check accuracy with different gauges and instruments. [Different components: - V' block, parallel bar, drill point angle; Different gauges: - sine bar, slip gauge & DTI (dial test indicator) and accuracy limit ±0.02 mm.]	Check tapered or angular jobs with help of sine bar, slip gauges and dial gauge Perform cylindrical and surfaces grinding operation Perform step grinding on cylindrical grinding machine Grind Parallel block on surface grinding machine Grind gauges within finish accuracy ±02mm	Use of snap gauges, sine bar and slip gauges their description and uses. Polishing, lapping powder and emery clothes lapping flat surface. Tools and cutter grinder their description, working principles, operations care and maintenance. Special types of grinding machines and centreless grinders. Their description, working principles, operations, care and maintenance. Diamond Wheel and Applications of diamond wheel in grinding.
Professional Skills – 40 Hrs Professional Knowledge – 10 Hrs	Perform preventive maintenance of grinding machines. [Grinding machines: - surface and cylindrical]	Make simple utility jobs such as V' block, Parallel bar, Drill point angle checking gauge with surface and cylindrical grinders Perform preventive maintenance of grinding machines	Preventive maintenance and its necessity. Mode of frequency of lubrication. Preparation of Maintenance schedule, simple estimation, use of hand book and reference table. Total preventive Maintenance.

GRINDER (OF)

Professional Skills – 40 Hrs Professional Knowledge – 10 Hrs	Make job of different material by cylindrical parallel grinding with appropriate accuracy. [Different material: - soft & hard metals; Accuracy limit±0.01mm]	Finish cylindrical surfaces by grinding within accuracy ±01mm (Maintaining parallelism) on both soft and hard metals	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.
Professional Skills – 40 Hrs Professional Knowledge – 10 Hrs	Perform operations on tools & cutter grinder and resharpening of different milling cutters [Different milling cutters: plain, slitting saw]	Manipulate and control tools and cutter grinding machine. Mount jobs on mandrel in tools and cutter grinding machine. Perform operation on tools and cutter grinding machine. Perform grinding of plain milling cutter Perform grinding of slitting saw milling cutter	Tool and cutter grinding machine parts and accessories, description use, care and maintenance, Milling cutters and its nomenclature. Grinding of bushes and cylinders steps and precautions to be taken.
Professional Skills – 65 Hrs Professional Knowledge – 15 Hrs	Make different components having straight & angular surface with close tolerance limit and check different fault. [Different components: - V' block, plain cylindrical bar, cube; tolerance limit - ±0.01mm; different faults - cracks, blow-holes, chatters]	Perform grinding on plain flat surface in surface grinding machine with close tolerances (±01mm) Perform grinding on angular surface like 'V' block Grind parallel block on surface grinding machine within close limits (±01mm) Perform plane cylindrical grinding to close limit with accuracy of h7 Perform cylindrical bore grinding within accuracy (±01mm) Set and grind jobs on chucks and face plates Balance grinding wheel	Dial test indicators marking block, height gauge and surface plate their description. Principle of vernier caliper, protractors, micrometers (O/S, I/S and depth) and other instruments having vernier graduations. Combination setstheir use care and maintenance. Bonding materials their kinds description and uses. Grade and structure at grinding wheels. Brief about ISO- 9000. Importance of Quality. Wheel marking system

GRINDER (OF)

		Mount grinding wheel Perform right angle grinding on surface grinding machine within accuracy ± 01mm Perform wheel dressing for rough and finishing grinding Grind a cube to close limit (Tolerance within ±01mm) Perform shoulder grinding on cylinder-grinding machine to close limit h7 Perform slot grinding on surface grinding machines to close limits H7 Find different faults while grinding	selection of wheels. Specification and types (shapes & size) of grinding wheels, diamond wheels and their uses. Mounting of grinding wheels, grinding wheels, collets and mandrels, balancing of grinding wheels by different methods. Types of dresses-steel type, abrasive Diamond tool and rotary dresses abrasive bricks and sticks their description, use, care and maintenance. Dressing and truing of grinding wheels advantage of balancing, inspections and care of grinding wheels. Wheel storage. Heat generated in grinding dry and wet grinding, use of coolants their composition and selection, limit, fit and tolerances as per ISI : 919-1963. Basic size and its deviation position of tolerance zone with respect to zero lines. Fits different types clearance, interference and transition Interchangeable system Letter symbols for holes and shafts and fundamental deviation hole basis and shaft basis systems.

GRINDER (OF)

Professional Skills – 40 Hrs **Professional Knowledge – 10 Hrs**	Make different gauges with close tolerance limit and check accuracy with different gauges. [Different gauges: - snap gauge, ring gauge; tolerance limit- (H7/h7); Checking gauges- ring, plug]	Grind Snap gauge in close limit to H6 Perform grinding on cylindrical taper using standards ring gauges Perform grinding of ring gauge using plug gauge Grinding long cylindrical using steady rest to close limit of h6	Gauges-feeler, taper gauge radius, plug, ring snap (fixed and adjustable) and slip their description use care and maintenance. Inside micrometer, depth gauge, special types of micrometers, universal dial test indicator their construction and function. 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: 19911962 machine guards etc. Process of cleaning and oiling at grinding machines (care and Maintenance) types of steady rests their description and use
Professional Skills – 40 Hrs **Professional Knowledge – 10 Hrs**	Produce different components of non-ferrous metal within appropriate accuracy. [Different components - taper pin, rectangular bar; accuracy limit- ±0.01mm.]	Grind thin plates to close limits of h6 using coolants Perform grinding on parallel and taper pins using chuck and collets-h6 Select grinding wheel and perform grinding on rectangular bar of non-ferrous metals within accuracy ±01mm	Principle types of grinding fluids importance of uniform temperature, selection and use at grinding fluids, method of supplying grinding fluids. Types of holding devices methods of holding work, type of centres - holdong work between centres types of chucks and holding process in chucks. 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,

GRINDER (OF)

			calculations at S.F.P.M.
Professional Skills – 40 Hrs Professional Knowledge – 10 Hrs	Produce different components involving cylindrical angular grinding operation to close limit accuracy. [Different components- lathe centre, milling machine arbor; accuracy:- h6 or H6]	Perform grinding on machine centre to close limit h6 or H6 Perform Facing and Chamfering within accuracy ±02mm Perform step grinding on surface grinding machine to close limit h6 or H6 Perform V-block grinding within accuracy ±01mm or ± 5 minutes	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. Surface grinding methods of surface grinding by using periphery of grinding wheel and ring edge of grinding wheel. Types of surface grinding machines. Work finish, wheel selection holding of work. Process of grinding angular surfaces. Grinding slots and grooves. Grinding "V" blocks. Recommended wheel speeds for surface grinding machines.
Professional Skills – 20 Hrs Professional Knowledge – 05 Hrs	Prepare surface of a component by honing operation & Check accuracy. [Accuracy limit: ±0.001mm]	Grind cylindrical steps and perform honing	Hones and Honing, types of honing stones there description and use. Amount and rate of stock removal. Adjustment for elementary honing conditions, honing tolerances.
Professional Skills – 65 Hrs Professional	Produce components by different taper	Finish surface of Angular form grinding within accuracy of ±01mm	Cylindrical-types of cylindrical grinding operation traverse method,

GRINDER (OF)

Knowledge – 15 Hrs	grinding operation and check accuracy. [Different taper grinding: - compound or double taper, steep taper, morse taper; accuracy limit- ±0.008mm.]	Grind cylindrical steps with shoulder and chamfer within accuracy ±08mm Perform compound or double taper grinding accuracy of ±08mm and surface finish of N5 Perform steep taper grinding with in accuracy ±08mm Grind lathe centre within accuracy ±08mm surface finish N4 Make Morse taper within accuracy ±08mm surface finish N4 Perform Plug grinding within accuracy ±08mm surface finish N4 Finish Metric tapers by grinding within accuracy ±08mm surface finish N4 Perform Taper grinding using sine bar, DTI and gauge blocks to close limit h6	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 Use of sine bar and gauge block-taper checking by sine bar gauge block D.T.I. micrometer and rollers. Other out of round surfaces. Holding work with fixed steady rest, in process gauges and pneumatic gauges.

GRINDER (OF)

Professional Skills – 40 Hrs **Professional Knowledge – 10 Hrs**	Produce male and female components by different grinding to close tolerance limit. [Different grinding: - step and slot grinding; tolerance limit- H6/h5]	Grind Taper up to close limit H6 Grind lathe centre within h7 Perform internal step grinding to close limit H6, Grind ring gauge to close limitH7 Perform slot grinding to close limit h5 Perform cylindrical step grinding	Centreless grinding process of holding job, and types of operations. Effect of setting work above and below wheel centre. Jig and fixture holding work by fixture and vice non-electric and magnetic chuck. Use of three jaw and two jaw steady rest 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 allowance, selection of wheels for internal grinding. Thread grinding method of holding jobs methods of grinding threads and thread calculation. Thread grinding method of holding jobs method of grinding threads and thread calculation. Various types of thread grinding wheels and their selection. Types of dressers and process of process of dressing selection of coolants and their use.

GRINDER (OF)

Professional Skills – 20 Hrs **Professional Knowledge – 05 Hrs**	Prepare surface of a job by performing lapping & buffing to close limit h5.	Perform Lapping on flat surface Perform Lapping on cylindrical surface Perform Buffing to close limits h5	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 polishing wheels polishing operations abrasive buffing wheels
Professional Skills – 40 Hrs **Professional Knowledge – 10 Hrs**	Make components by different grinding to close tolerance limit and check accuracy. [Different grinding: - cylindrical taper, surface grinding & shoulder grinding; tolerance limit- h6]	Perform cylindrical Taper grinding Perform surface grinding within accuracy ±01mm Perform Multi-step cylindrical grinding Perform shoulder grinding on cylinder-grinding machine to close limit h7	-Do- Grinding defects and their corrections, inaccurate work out of round, out of parallel taper on and irregular marks spiral scratches, discoloured burnt surface etc. Grinding defects and their correction. Waviness marks of surface, chattersshort close evenly spaced long and regularly spaced, marks in phase with vibration of floor, random marks, random waves etc. Glazing of wheel and loading of wheel. Dressing and truing of grinding wheels advantage of balancing, inspections and care of grinding wheels. Wheel storage.

SYLLABUS FOR CORE SKILLS

Workshop Calculation & Science

LEARNING OUTCOME	ASSESSMENT CRITERIA
1. Demonstrate basic mathematical concept and principles to perform practical operations.	Solve different problems like unit conversion etc. with the help of a calculator.
	Demonstrate conversion of Fraction to Decimal and vice versa.
	Solve simple problems on area, perimeter etc of regular shapes.
	Solve simple trigonometric ratios and height & distance.
2. Understand and explain basic science in the field of study including simple machine.	Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure.
	Explain relationship between different scales of temperature, concept of heal and temperature.
	Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.

Sl. No.	Syllabus	Time in hrs.
I.	**Unit, Fractions**	**4**
1	Classification of Unit System	
2	Fundamental and Derived Units F.P.S, C.G.S, M.K.S and SI Units	
3	Measurement Units and Conversion	
4	Factors, HCF, LCM and Problems	
III.	**Material Science**	**4**
1	Types of metals	
2	Physical and Mechanical Properties of metals	
3	Types of ferrous and non-ferrous metals	
IV.	**Mass, Weight, Volume, and Density**	**4**
1	Mass, volume, density, weight & specific gravity	
2	Related problems for mass, volume, density, weight & specific gravity	
V.	**Speed and Velocity, Work Power and Energy**	**6**
1	Rest, motion, speed, velocity, difference between speed and velocity, acceleration and retardation	

2	Related problems on speed and velocity	
VI.	**Heat &Temperature and Pressure**	**4**
1	Concept of heat and temperature, effects of heat, difference between heat and temperature	
2	Scales of temperature, Celsius, Farenhieght,Kelvin and Conversion between scales of temperature	
VII.	**Basic Electricity**	**6**
1	Introduction and uses of electricity, molecule, atom, how electricity is produced, electric current AC, DC and their comparison, voltage , resistance and their units	
2	Conductor, Insulator, types of connections- Series and Parallel,	
	Ohm's Law, relation between VIR & related problems	
3	Electrical power, energy and their units, calculation with assignments	
VIII.	**Mensuration**	**6**
1	Area and perimeter of square, rectangle and parallelogram	
2	Area an Perimeter of Triangle	
3	Area and Perimeter of Circle, Semi-circle , circular ring, sector of circle, hexagon and ellipse	
X.	**Trigonometry**	**6**
1	Measurement of Angle, Trigonometrical Ratios, Trigonometric Table	
2	Trigonometry-Application in calculating height and distance (Simple Applications)	
	Total	**40**

Engineering Drawing

LEARNING OUTCOME WITH ASSESSMENT CRITERIA

ENGINEERING DRAWING	
LEARNING OUTCOME	**ASSESSMENT CRITERIA**
1. Read and apply engineering drawing for different application in the field of work.	Read & interpret the information on drawings and apply in executing practical work.
	Read & analyse the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.

GRINDER (OF)

Sl. No.	Topic	Time in hrs.
1.	Engineering Drawing – Introduction Introduction to Engineering Drawing and Drawing Instruments – • Conventions • Viewing of engineering drawing sheets. • Method of Folding of printed Drawing sheet as per BIS SP: 46-2003	1
2.	Drawing Instrument • Drawing board, T-square, Drafter (Drafting M/c), Set squares, Protector, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), pencils of different grades, Drawing pins/ Clips.	1
3.	Free hand drawing of – • Lines, polygons, ellipse etc. • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the free hand sketches. • Solid objects – Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone with dimensions.	6
4.	Lines • Definition, types and applications in drawing as per BIS: 46-2003 • Classification of lines (Hidden, centre, construction, extension, Dimension, Section) • Drawing lines of given length (Straight, curved) • Drawing of parallel lines, perpendicular line	2
5.	Drawing of Geometrical figures: Definition, nomenclature and practice of – • Angle: Measurement and its types, method of bisecting. • Triangle: different types • Rectangle, Square, Rhombus, Parallelogram. • Circle and its elements	4
6.	Dimensioning and its Practice • Definition, types and methods of dimensioning (functional, non-functional and auxiliary) • Position of dimensioning (Unidirectional, Aligned) • Types of arrowhead	4
7.	Sizes and layout of drawing sheets • Selection of sizes • Title Block, its position and content	2

	• Item Reference on Drawing Sheet (Item list)	
8.	Method of presentation of Engg. Drawing • Pictorial View • Orthographic View • Isometric View	2
9.	Symbolic representation – different symbols used in the trades • Fastener (Rivets, Bolts and Nuts) • Bars and profile sections • Weld, Brazed and soldered joints • Electrical and electronics element • Piping joints and fitting	6
10.	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 in 3rd angle.	8
11.	Reading of fabrication drawing	4
Total		**40**

ABBREVIATIONS

CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Craft Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprenticeship Certificate
NCIC	National Craft Instructor Certificate

ANNEXURE-I

MACHINIST GRINDER			
LIST OF TOOLS AND EQUIPMENT (For batch of 20candidates)			
S No	**Name of the Tool &Equipment**	**Specification**	**Quantity**
A. TRAINEES TOOL KIT			
1.	Steel Rule	150mm (graduated both English and Metric).	21 (20+1) Nos.
2.	Try Square Engineer	150mm	21 (20+1) Nos.
3.	Outside Calipers (spring)	250mm	21 (20+1) Nos.
4.	Inside Calipers (spring)	150 mm	21 (20+1) Nos.
5.	Hammer Ball Peen	With handle 0.50 kg.	21 (20+1) Nos.
6.	Odd leg Caliper	150 mm	21 (20+1) Nos.
7.	Scriber	150 x 3 mm	21 (20+1) Nos.
8.	Plier	150 mm	21 (20+1) Nos.
9.	Goggles	(fiber plastic cup) safety glasses (interchangeable glasses)	21 (20+1) Nos.
B. TOOLS, MEASURING INSTRUMENTS AND GENERAL SHOP OUTFIT			
10.	Hammer Copper	0.50 kg.	3 Nos.
11.	Hammer Engineers	Ball Peen 0.50 kg.	3 Nos.
12.	Scribing Block	with adjustable Vertical spindle 225 mm 4 Angle Plate, adjustable (graduated in degrees) 150 x 150 x 150 mm	3 Nos.
13.	Blocks Vee	150 x 100 x 100 mm (fitted with clamps, hardened and ground)	3 Pairs.
14.	Blocks Vee	(grooved and fitted with clamps) (Hardened and ground) 75 x 75 x 50 mm	3 Pairs.
15.	Block parallel	adjustable 150 mm long, 42 mm wide, 18 mm height (hardened and ground)	3 Pairs.
16.	Block, parallel	adjustable 100 mm long, 50 mm wide, 32 mm height (hardened and ground)	3 pairs.
17.	Calipers, Vernier	200 mm, inside and outside (graduated in inches and millimeters	1 Each
18.	C-clamps	50 mm, 100 mm and 150 mm	3 Each
19.	Oil can	Pressure delivery 1/4 pint	4 Nos.
20.	Oil can	Drip delivery (long spout) 200 ml. capacity	4 Nos.

GRINDER (OF)

21.	Height Gauge	(Metric and English graduated)	1 No.
22.	Combination set	(consisting of 300 mm rule centre)	2 Nos.
23.	Comparator Gauge	complete with stand and brackets.	2 Nos.
24.	Chuck, Drill	12 mm cap. (Taper shank)	1 No.
25.	Chuck, Drill	16 mm capacity (Taper shank)	1 No.
26.	Dial Test Indicator complete	with stand (universal type with magnetic base 1/100 mm)	2 Nos.
27.	Diamond, Wheel Dressing	single stone mounted	4 Nos.
28.	Files, Hand Flat,	200 mm smooth	10 Nos.
29.	Files, Hand Flat,	250 mm smooth	10 Nos.
30.	Files, Half round	150 mm smooth	10 Nos.
31.	Files, round	Dead smooth 200 mm	4 Nos.
32.	Files, Triangular,	Dead smooth 200 mm	2 Each
33.	Files, Triangular	Dead smooth 150 mm	4 Nos.
34.	File Flat Rough	300 mm	4 Nos.
35.	File Flat	250 mm Second Cut	4 Nos.
36.	Chisel Cold Flat	18 mm	4 Nos.
37.	Chisel Cold Flat	12 mm	4 Nos.
38.	Feeler Gauge	Metric Set	1 set
39.	Gauge Radius (Inside and Outside)	Metric	2 Nos.
40.	Slip Gauge, workshop grade	Metric	2 Sets
41.	Sine Bar	100 mm and 150mm	1 Each
42.	Gauge, Telescopic	12 to 150 mm	2 Sets
43.	Gauge, Morse Taper,	Plug Nos. 1,2,3,4	1 Each
44.	Gauge, Morse Taper,	Ring Nos. 1,2,3,4	1 Each
45.	Glass, Magnifying	250 x 25 x 75 mm dia with handle	1 No.
46.	Hacksaw frame	200 to 300 mm adjustable	2 Nos.
47.	Keys, Allen	1 mm to 14 mm by 1 mm	4 sets
48.	Keys, Allen	3 to 12 mm, by 1.5 mm	1 Set
49.	Spirit Level, Engineers	25 mm precision	1 No.
50.	Micrometer outside	0 to 25 mm	3 nos.
51.	Micrometer outside	25 to 50 mm	2 nos.
52.	Micrometer outside	50 to 75 mm	1 no.
53.	Micrometer outside	75 to 100 mm	1 no.
54.	Internal Micrometer	25 to 150 mm with extension Rods.	1 no.
55.	Depth Gauge Micrometer	with extension rods to 150 mm with 70 mm Base	1 no.
56.	Indicating Micrometer	0.25 mm range, graduation, 01" mm graduation of dial 0.001 mm range of dial + 0.02	1 No.

GRINDER (OF)

57.	Oil Stone Carborandum,	Coarse on one side and fine on the other 200 x 50 x 25 mm	2 Nos.
58.	Oil Stone Carborandum,	Coarse on one side and fine on other slip 100 x 12 mm triangular.	2 Nos.
59.	Oil Stone Carborandum,	Coarse on one side and fine on other slip 100 x 18 mm triangular	2 Nos.
60.	Try Square, Engineer's	100 mm blade	2 Nos.
61.	Straight Edge Engineer's	300 x 50 x 12 mm beveled edge.	1 No.
62.	Screw Driver	200 mm blade	2 Nos.
63.	Screw Driver	300 mm blade	2 Nos.
64.	Spanner D.E. open jaw	3 to 18 mm by 3 mm	2 Sets
65.	Scraper Flat	25 x 200 mm with handle	2 Nos.
66.	Scraper Half round	75 x 12 x 200 mm with handle	2 Nos.
67.	Scraper Triangular	62 x 9 x 200 mm with handle	2 Nos.
68.	Techometer	with male and female rubber attachments (upto10,000 RPM)	1 No.
69.	Table Chuck	75 mm Jaw Swivel Base 200 mm dia. 3 Jaw with bolting arrangement and graduated in degrees	1 No.
70.	Vices, Machine Plain	150 Jaws x 100 mm openings	2 Nos.
71.	Vices, Machine, SwivelingBase	150 mm x 100 mm	2 Nos.
72.	Universal Machine Vice	100 mm for Grinding	2 Nos.
73.	Wheel Dressers, Steel Type	Huntington - Large	2 Nos.
74.	Wheel Dressers, Steel (Huntington type Small)		3Nos.
75.	Radius Truing Attachment for surface grinding machine		1No.
76.	Radius Truing Attachment for cylindrical grinding machine.		1No.
77.	Angle Truing Attachment for surface grinding machine.		1 No.
78.	Demagnetizer Chuck		1 No.
79.	Centre Punch	150 x 6 mm dia.	4 Nos.
80.	Reamer Adjustable	6 to 16 x 1.5 mm	1 Set
81.	Surface Plate	60 x 60 cms.	1 No.
82.	Marking Table 90 x 60 x 90 cms	90 x 60x 90 cms.	1 No.
83.	Hand Drill	6 mm	1 Set
84.	Taps and Dies complete set in box	Metric	1 Set
85.	Taps and Dies set BA.BSF. BSW and American		1 Set
86.	Drill Twist (Straight Shank)	1/8" to 1/2" by 1/64"	1 Set

GRINDER (OF)

87.	Drill Twist (Metric)	3 mm to 12 mm, in step of 1 mm	1 Set
88.	Set of Sockets Morse taper	(0-1, 1-2 and 2-3)	1 Set
89.	Drill Chuck	0 to 12 mm Morse Taper	1 No.
90.	Combination Drill (Centering)		2 Nos.
91.	Screw Pitch Gauge		2 Nos.
92.	Working Benches	340 x 120 x 75 cms with 4 bench vices, 125 mm jaw	1 No.
93.	Fire Extinguisher		1 No.
94.	Fire Buckets with stand		4 Nos.
95.	Steel lockers	with 6 drawers	2 Nos.
96.	Metal Rack	180 x 150 x 45 cms.	1 No.
97.	Desk		1 No.
98.	Stool		1 No.
99.	Black Board with Easel		1 No.
100.	Magnifying Glass with surface illuminator		1 No.
101.	CMTI surface finish standards (in Bakelite)		1 No.
102.	Adjustable Wrench	250 mm size	1 No.
103.	Hammer (Nylon face)	30 mm	4 Nos.
104.	Grease Gun		2 Nos.
105.	Magnetic V-Block with push button switch		1 Set
106.	Magnetic V-Block base	for Dial Indicator 75 x 75 x 100 mm	2 Nos.
107.	Diamond Dresser Cluster type		2 Nos.
108.	Adjustable Parallel Clamps	(Hardened and ground) 100 mm long	2 Pairs
109.	Granite Stone Surface Plate	Grade A 600 x 500 x 1000 mm	1 No.
110.	Static balancing stand for grinding wheel		1 No.
111.	Soft Board for display	1.25 mm x 1.85 mm x 10 mm thick	1 No.
112.	Dial Test Indicator-Lever type-long point		2 Nos.
113.	Magnetic Stand Flexible	type base 60 mm x 47.5 mm Magnetic Power 75 kg. ON-OFF Lever control	2 Nos.
114.	Cutter Clearance Gauge to Suit Clearance all cutter diameters	angle 0"-30".	1 Set
115.	Glass Show Case	for display of jobs 450 mm x 600 x 850mm	1 No.
C. DESIRABLE			
116.	Shadeograph projector	Withdiascopic and epidiascopic projection, magnification 50, 100, 200,	1 No.

GRINDER (OF)

		rotary screen 1 minute accuracy and centering, attachment.	
D : GENERAL MACHINERY			
117.	SS and SC centre lathe (all geared)	with minimum specification as: centre height 150 mm and centre distance 750 mm along with 4 jaw chuck, self centering chuck, auto feed system, safety guard, motorized coolant system and lighting arrangement, set of lathe tools, lathe carriers.	3 Nos.
118.	Pillar Drill machine	0-12mm drill holding capacity with drill chuck & keys.	1 No.
119.	Cylindrical External Grinding Machine	fully motorized with dressing arrangement and supplied with face plates and driving dogs, 3-jaw self centering chuck, 4- jaw independent chuck, tail stock assorted centres pump with tank 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) with minimum specification as: To accommodate 750mm job with centre height 150mm. Wheel diameter x Width = 300 x 25mm.	3 Nos.
120.	Grinding machine plain surface	wheel dia. 175 mm (or near) with reciprocating table having longitudinal table traverse 200 mm (or near) fully automatic and fitted with adjustable traverse stops, 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.
121.	Grinding machine plain surface	With horizontal and vertical spindle, reciprocating table having longitudinal table traverse fully motorized and supplied with set of spanners, necessary equipment, diamond tool holders for	2 Nos.

GRINDER (OF)

		wheel sized 175 x 30 x 18 mm suitable cup wheels for vertical spindle, spare wheel proper guards and coolant pump with fittings.	
122.	Tool and cutter grinding machine	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 attachment).	1 No.
123.	Lapping machine	with motor and chuck 132 cm dia.	1 No.


कौशलं बलम्