CURRICULUM

FOR THE TRADE OF

MACHINIST (GRINDER)

UNDER

APPRENTICESHIP TRAINING SCHEME

सत्यमेव जयते
Government of India

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

CONTENTS

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Co-ordinator for the course: Sh. Nirmalya Nath., ADT

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2. BACKGROUND

2. 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.

2. 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.

2. 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.

3. RATIONALE

(Need for Apprenticeship in **Machinist - Grinder** trade)

1. The greater degree of relevance of the training with latest advancements of the industry will enhance the employability opportunities
2. Ability to use powerful yet precise metal cutting tools to produce accurate metal parts exactly to specifications provided to him in mechanical drawings.
3. Acquire knowledge of the properties of the material he will be cutting and the capabilities of the tool he will be using.
4. Ability to know how much metal can be removed from a particular part using a particular tool in a given amount of time.
5. Able to decide how the piece of material will be held on the machine while it is cut and in what order the cuts will be made.
6. Provide exposure to use special fixtures can be made to hold the part and make them as well.
7. Able to accurately measure the part while it is being made and when it is done to assure it is made to the specified limits of size tolerance.
8. Ability to make parts to certain tighter value of tolerances and greater accuracy.
9. Exposure to use their knowledge of the working properties of metals and their skill with machine tools to plan and carry out the operations needed to make machined products that meet precise specifications.
10. Exposure to produce large quantities of one part, especially parts requiring the use of complex operations and great precision.
11. Able to repair or make new parts for existing machinery.

4. JOB ROLES: REFERENCE NCO

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:

1. **NCO-2004:** 7224.10
2. **NCO-2004:** 7224.30
3. **NCO-2004:** 7224.40
4. **NCO-2004:** 7224.45
5. **NCO-2004:** 8211.55

5. GENERAL INFORMATION

1. **Name of the Trade** **: MACHINIST (GRINDER)**

2. **N.C.O. Code No.** **: NCO-2004:** 7224.10, 8211.55, 7224.40, 7224.45, 7224.30

3. **Duration of Apprenticeship Training (Basic Training + Practical Training):**2years

3.1 **For Freshers: -** Duration of Basic Training: -

a) Block –I : 3 months

b) Block – II : 3 months

Total duration of Basic Training: **6 months**

Duration of Practical Training (On -job Training): -

a) Block–I: 9 months

b) Block–II : 9 months

Total duration of Practical Training: **18 months**

3.2 **For ITI Passed: -** Duration of Basic Training: - **NIL**

Duration of Practical Training (On -job Training): **12 months**

4. **Entry Qualification** : Passed 10^{th} Class with science and mathematics under 10+2 system of education or its equivalent

5. **Selection of Apprentices:** The apprentices will be selected as per Apprentices Act amended time to time.

6. **Rebate for ITI passed trainees** : i) **One year** in the trade of **Machinist Grinder**

ii) **One year** in the trade of **Machinist/ 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.

6. COURSE STRUCTURE

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**

Components of Training	Duration of Training in Months																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Basic Training Block - I																								
Practical Training Block - I																								
Basic Training Block - II																								
Practical Training Block - II																								

7. SYLLABUS

7.1 BASIC TRAINING
(BLOCK – I & II)
DURATION: 06 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** : **MACHINIST (GRINDER)**
2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)
3) **Batch size** : 16
4) **Power Norms** : 23.4 KW for Workshop
5) **Space Norms** : 103 Sq. m.

6) **Examination** : The internal assessment will be held on completion of each Block.
7) **Instructor Qualification** :

i) Degree/Diploma in **Mechanical** Engg. from recognized university/Board with one/two year post qualification experience respectively in the relevant field.

OR

ii) NTC/NAC in the trade of **Machinist Grinder** with three year post qualification experience in the relevant field.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

8) **Tools, Equipments & Machinery required**: - As per Annexure – I

7.1.1 DETAIL SYLLABUS OF CORE SKILL

A. Block– I
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1.	**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.	**30**	**Units & Measurements-** FPS, CGS, MKS/SI unit, unit of length, Mass and time. Fundamentals and derived units Conversion of units and applied problems.	**20**
2.	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		**Material Science** : properties - Physical & Mechanical, Types - Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals	
3.	**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.		**Mass .Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density,	
4.	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view		**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	
5.	**Constructions: -** Draw proportionate free hand sketches of plane figures. Sketch horizontal, vertical and inclined line by free hand, Draw circles by free hand using square and radial line method, Draw arcs and ellipse by free hand		**Ratio & Proportion** : Simple calculation on related problems. **Percentage:** Introduction, Simple calculation.	
6.	Projections: Concept of axes plane and quadrant. Orthographic projections Method of first angle and third angle projections (definition and difference) Symbol of 1^{st} angle and 3^{rd} angle projection as per IS specification. Free hand Drawing of Orthographic projection from isometric/3D view of geometrical blocks		**Work, Power and Energy:** work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy. Meaning of H.P., I.H.P., B.H.P., and F.H.P. and CC and Torque.	

B. Block- II
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1.	**Screw :-** Its Types and Sizes, Screw thread, their standard forms as per BIS, external and internal thread.	**30**	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	**20**
2.	**Rivets and Joints:-** Prepare a drawing sheet on rivets nomenclature and Joints.		**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.	
3.	Free hand Sketches for simple pipe line with general fittings.		**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.	
4.	Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.		**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.	
5.	Simple exercises related to trade related symbols. Basic electrical and electronic symbols		**Simple machines** **Transmission of power:** - Transmission of power by belt, pulleys & gear drive. **Heat treatment process: -**	

			Heat treatment and advantages. Annealing, Normalizing, Hardening, Tempering.	
6.	Free hand sketch of trade related components / parts /cutting tool indicating angles.		**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding the value of unknown sides and angles of a triangle by Trigonometrical method. 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.**			

7.1.2 DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

A. Block –I

Basic Training

Week No.	Professional Skills	Professional Knowledge
1.	Safety: - its importance, classification, personal, general, workshop and job safety. Occupational health and safety. Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Importance of housekeeping & good shop floor practices. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Fire& safety: Use of Fire extinguishers.	Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Institute system including stores procedures. Introduction of First aid. Safety attitude development of the trainee by educating him to use Personal Protective Equipment (PPE). Response to emergencies eg; power failure, fire, and system failure. Accidents- Definition types and causes. First-Aid, nature and causes of injury and utilization of first-aid. Introduction to 5S concept & its application. Fire: - Types, causes and prevention methods. Fire Extinguisher, its types. Global warming its causes and remedies. Industrial Waste its types, sources and waste Management.
2.	Identification of tools & equipments as per desired specifications for marking & sawing(Hand tools , Fitting tools & Measuring tools) Selection of material as per application Visual inspection of raw material for rusting, scaling, corrosion etc. Uses of marking tools, Punch, Try square & basic measuring tools, caliper, steel rule. Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions, sawing different types of metals of different sections. **Practical on marking, punching and rough grinding on pedestal grinder.** Filling practice.	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. 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.

	Grinding of Chisels, Measuring different types of jobs by steel rule caliper etc.	
3.	Drilling different sizes of holes. Practice tapping and threading with tap & dies. Centre lathe and parts, setting of jobs and Parallel turning, taper turning using compound rest. 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, Normalising, 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.	V- thread cutting (External) 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.	Demonstration on selection of grinding wheels for grinding different metals, selection of suitable wheel to obtain rough and IS: 1249- 1958. Grinding different metals with suitable grinding wheels. Setting grinding wheel on wheel flange, truing and balancing of wheels. Dressing of grinding wheel Grinding practice on surface and cylindrical grinding machine. Checking measuring various types of jobs using micrometers, Vernier caliper, Vernier Height gauge etc.	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: 551-1966.

6.	Grinding sockets and checking depth by depth gauge micrometer.	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.	Machine setting for automatic movements and parallel grinding on cylindrical grinder. Testing and mounting wheels sleeves, truing and rebalancing and grinding parallel mandrel. 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.	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.	Dry and wet grinding of different classes of metals such as cast iron , barzed carbide tip and different classes of steel. 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.	Grinding practice on drills reamers and taps. 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.	Grinding internal bore of cylindrical job and use of telescopic gauge.	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.
12.	Preventive maintenance of grinding machines (Surface & Cylindrical).	Preventive maintenance and its necessity. Mode of frequency of lubrication. Preparation of Maintenance schedule, simple estimation, use of hand book and reference table.
13.	**Revision & Internal Assessment**	

B. Block –II
Basic Training

Week No.	Professional Skills	Professional Knowledge
1.	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.	Parallel block grinding on surface grinding machine within close limits. 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.	Slot grinding practice on surface grinding machines to close limits H7. 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.	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.

5.	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.	Introduction to CNC machine operation like Jog, Reference Edit, MDI ,Auto Mode Prog. Call & Entry, Tool off-set & Tool changing /Orientation.	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.
7.	Compound or double taper grinding practice on cylindrical grinder.	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.	Grinding Taper up to close limit H6. 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.	Practice on tools and cutter grinding machine. 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.	Form grinding radius angle. Grinding/resharpening of angular cutter by using work head.	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.
11.	Slitting saw sharpening practice using tooth rest.	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.

12.	Practice sharpening end mill cutter and sharpening tap	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.	**Revision & Internal Assessment**	

7.1.3 EMPLOYABILITY SKILLS

GENERAL INFORMATION

1)	**Name of the subject**	**:**	**EMPLOYABILITY SKILLS**
2)	**Applicability**	**:**	ATS- Mandatory for fresher only
3)	**Hours of Instruction**	**:**	**110 Hrs. (55 hrs. in each block)**
4)	**Examination**	**:**	The examination will be held at the end of two years Training by NCVT.
5)	**Instructor Qualification**	**:**	

i) MBA/BBA with two years experience or graduate in sociology/social welfare/Economics with two years experience and trained in Employability skill from DGET Institute.

And

Must have studied in English/Communication Skill and Basic Computer at 12th /diploma level

OR

ii) Existing Social Study Instructor duly trained in Employability Skill from DGET Institute.

7.1.3.1 SYLLABUS OF EMPLOYABILITY SKILLS

A. Block – I
Basic Training

Topic No.	Topic	Duration (in hours)
	English Literacy	**15**
1	**Pronunciation :** Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
2	**Functional Grammar** Transformation of sentences, Voice change, Change of tense, Spellings.	
3	**Reading** Reading and understanding simple sentences about self, work and environment	
4	**Writing** Construction of simple sentences Writing simple English	
5	**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.	
	I.T. Literacy	**15**
1	**Basics of Computer** Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
2	**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.	
3	**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	
4.	**Computer Networking and INTERNET** Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks),	

	Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.	
	Communication Skill	**25**
1	**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. Case study/Exercise	
2	**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.	
3	**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. Case study/Exercise	
4	**Facing Interviews** Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview	
5	**Behavioral Skills** **Organizational Behavior** Problem Solving Confidence Building Attitude Decision making Case study/Exercise	

B. Block– II
Basic Training

Topic No.	Topic	Duration (in hours)
	Entrepreneurship skill	**15**
1	**Concept of Entrepreneurship** **Entrepreneurship**- 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.	
2	**Project Preparation & Marketing analysis** Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of Product Life Cycle (PLC), Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.	
3	**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.	
4	**Investment Procurement** Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.	
	Productivity	**10**
1	**Productivity** Definition, Necessity, Meaning of GDP.	
2	**Affecting Factors** Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.	
3	**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.	
4	**Personal Finance Management** Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	Occupational Safety, Health & Environment Education	**15**
1	**Safety & Health** Introduction to Occupational Safety and Health importance of safety and health at workplace.	

2	**Occupational Hazards** Basic Hazards, Chemical Hazards, Vibro-acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.	
3	**Accident & safety** Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.	
4	**First Aid** Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
5	**Basic Provisions** Idea of basic provision of safety, health, welfare under legislation of India.	
6	**Ecosystem** Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.	
7	**Pollution** Pollution and pollutants including liquid, gaseous, solid and hazardous waste.	
8	**Energy Conservation** Conservation of Energy, re-use and recycle.	
9	**Global warming** Global warming, climate change and Ozone layer depletion.	
10	**Ground Water** Hydrological cycle, ground and surface water, Conservation and Harvesting of water	
11	**Environment** Right attitude towards environment, Maintenance of in -house environment	
	Labour Welfare Legislation	**5**
1	**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.	
	Quality Tools	**10**
1	**Quality Consciousness :** Meaning of quality, Quality Characteristic	
2	**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.	
3	**Quality Management System :** Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.	
4	**House Keeping :** Purpose of Housekeeping, Practice of good Housekeeping.	
5	**Quality Tools** Basic quality tools with a few examples	

7.2 PRACTICAL TRAINING (ON-JOB TRAINING)
(BLOCK – I & II)
DURATION: 18 MONTHS (9 months in each block)

GENERAL INFORMATION

1) **Name of the Trade** : **MACHINIST (GRINDER)**

2) **Batch size** : a) Apprentice selection as per Apprenticeship guidelines.

b) Maximum16 candidates in a group.

3) **Examination** : i) The internal assessment will be held on completion of each block

ii) NCVT exam will be conducted at the end of 2nd year.

4) **Instructor Qualification** :

i) Degree/Diploma in **Mechanical** Engg. from recognized university/Board With one/two year post qualification experience in the relevant field.

OR

ii) NTC/NAC in the trade of **Machinist Grinder** with three year post qualification experience in the relevant field.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

5) **Infrastructure of On-Job Training** : - As per Annexure – II

7.2.1 BROAD SKILL COMPONENT TO BE COVERED DURING ON-JOB TRAINING

A. BLOCK – I (09 months)

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.

B. BLOCK – II (09 months)

1. Perform thin plate grinding using coolant to close limits within ±0.005 mm.
2. Perform slot grinding on surface grinding machine to close limit (within ±0.005 mm) and check for accuracy without any assistance.
3. Perform different types of bore grinding within accuracy (within ±0.005 mm) and check for accuracy.
4. Interpretation and measurement of different quality aspects e.g. surface finish, diameter and geometric tolerances.
5. Usage of gauges and comparators, specially pneumatic and electronic gauging system.
6. Understand working of tool and cutter grinder, set and resharpen the plain/slot/side and face milling cutter and check for accuracy.
7. Set and resharpen the slitting saw, spiral milling cutter, end mill cutter, angular milling cutter, tap, reamer drill, and check for accuracy.
8. Perform form grinding viz., angular, concave, convex using cylindrical and surface grinder.

9. Perform steep taper, morse taper, lathe centre grinding up to close limit and check for accuracy.
10. Grind different precession components viz. dowel pin, sinebar, slip gauges.
11. 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.
12. 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.
13. Understand working of thread grinding machine tool and perform different types of thread grinding and check for accuracy.
14. Understand working of CNC surface and/or grinder and perform different types of flat job grinding and check for accuracy.
15. 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)
16. Perform basic preventive maintenance of CNC grinding machines.
17. Perform TPM (Total Productive Maintenance), TQM (Total Quality Management) and record keeping system.

8. ASSESSMENT STANDARD

8.1 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 to be given while assessing for team work, avoidance/reduction of scrape/wastage and disposal of scarp/wastage as per procedure, behavioral attitude and regularity in training.

The following marking pattern to be adopted while assessing:

a) Weightage in the range of 60-75% to be allotted during assessment under following performance level:

For 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.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- many tolerances while undertaking different work are in line with those demanded by the component/job.
- 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 under following performance level:

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.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- the majority of tolerances while undertaking different work are in line with those demanded by the component/job.
- 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 under following performance level:

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.

In this work there is evidence of:

- high skill levels in the use of hand tools, machine tools and workshop equipment
- tolerances while undertaking different work being substantially in line with those demanded by the component/job.
- a high level of neatness and consistency in the finish.
- minimal or no support in completing the project

8.2 FINAL ASSESSMENT- ALL INDIA TRADE TEST

(SUMMATIVE ASSESSMENT FOR TWO YEARS TRADE)

SUBJECTS	Marks	Sessional Marks	Full Marks	Pass Marks	Duration of Exam.
Practical	300	100	400	240	**08 hrs.**
Trade Theory	100	20	120	48	3 hrs.
Workshop Cal. & Sc.	50	10	60	24	3 hrs.
Engineering Drawing	50	20	70	28	4 hrs.
Employability Skill	50		50	17	2 hrs.
Grand Total	**550**	**150**	**700**	**-**	

Note: - The candidate pass in each subject conducted under all India trade test.

9. FURTHER LEARNING PATHWAYS

- On successful completion of the course trainees can opt for Diploma course (Lateral entry). [Applicable for candidates only who undergone ATS after CTS]
- On successful completion of the course trainees can opt for CITS course.

Employment opportunities:

On successful completion of this course, the candidates may be gainfully employed in the following industries:

1. Production & Manufacturing industries.
2. Automobile and allied industries
3. Service industries like road transportation and Railways.
4. Ship building and repair
5. Infrastructure and defence organisations
6. In public sector industries (Central and State) and private industries in India & abroad.
7. Self employment

ANNEXURE – I

TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: MACHINIST (GRINDER)

LIST OF TOOLS & EQUIPMENTS FOR 16 APPRENTICES

A : TRAINEES TOOL KIT:

Sr. No.	Description	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 (fiber plastic cup) safety glasses (interchangeable glasses)	16 Nos.

B: TOOLS, INSTRUMENTS, AND GENERAL SHOP OUT FITS

Sr. No.	Description	Quantity
M 1.	Hammer Copper 0.50 kg.	2 Nos.
M 2.	Hammer Engineers, Ball Peen 0.50 kg.	2 Nos.
M 3.	Scribing Block with adjustable Vertical spindle 225 mm 4 Angle Plate, adjustable (graduated in degrees) 150 x 150 x 150 mm	2 Nos.
M 4.	Blocks Vee 150 x 100 x 100 mm (fitted with clamps, hardened and ground)	2 Pairs.
M 5.	Blocks Vee (grooved and fitted with clamps) (Hardened and ground) 75 x 75 x 50 mm	2 Pairs.
M 6.	Block parallel, adjustable 150 mm long, 42 mm wide, 18 mm height (hardened and ground)	2 Pairs.
M 7.	Block, parallel, adjustable 100 mm long, 50 mm wide, 32 mm height (hardened and ground)	2 pairs.
8.	Calipers, Vernier 200 mm, inside and outside (graduated in inches and millimeters_	1 Each
9.	Calipers, Vernier, outside 300 mm (graduated in inches and millimeters)	4 Nos.
10.	C-clamps 50 mm, 100 mm and 150 mm	2 Each
M 11.	Oil can, Pressure delivery _1/4 point capacity	4 Nos.
M12.	Oil can Drip delivery (long spout) _ point capacity	4 Nos.
13.	Height Gauge (Metric and English graduated)	1 No.
14.	Combination set (consisting of 300 mm rule centre)	2 Nos.
15.	Comparator Gauge, complete with stand and brackets.	2 Nos.

16.	Chuck, Drill 12 mm cap. (Taper shank)	1 No.
17.	Chuck, Drill 16 mm capacity (Taper shank)	1 No.
18.	Dial Test Indicator complete with stand (universal type with magnetic base 1/100 mm)	2 Nos.
19.	Diamond, Wheel Dressing (single stone mounted)	4 Nos.
20	Files, Hand Flat, 200 mm smooth	8 Nos.
21.	Files, Hand Flat, 250 mm smooth	8 Nos.
22.	Files, 150 mm Half round smooth	8 Nos.
23.	Files, round Dead smooth 200 mm	4 Nos.
24.	Files, Triangular, Dead smooth 200 mm and 150 mm	2 Each
25.	Files, Triangular Dead smooth 150 mm	4 Nos.
A 26.	File Flat Rough 300 mm	4 Nos.
A 27.	File Flat 250 mm Second Cut	4 Nos.
A 28.	Chisel Cold Flat 18 mm	4 Nos.
A 29.	Chisel Cold Flat 12 mm	4 Nos.
30.	Feeler Gauge Metric Set	1 set
31.	Gauge Radius (Inside and Outside) (Metric)	2 Nos.
32.	Gauge, Slip (Metric) workshop grade	2 Sets
33	Sine Bar 100 mm and 150mm	1 Each
34.	Gauge, Telescopic 12 to 150 mm	2 Sets
35.	Gauge, Morse Taper, Plug Nos. 1,2,3,4	1 Each
36.	Gauge, Morse Taper, Ring Nos. 1,2,3,4	1 Each
37.	Glass, Magnifying 250 x 25 x 75 mm dia with handle	1 No.
38.	Hacksaw frame 200 to 300 mm adjustable	2 Nos.
M 39.	Keys, Allen 1 mm to 14 mm by 1 mm	4 sets
40.	Keys, Allen 3 to 12 mm, by 1.5 mm	1 Set
41.	Spirit Level, Engineers 25 mm precision	1 No.
42.	Micrometer outside 0 to 25 mm	3 nos.
43.	Micrometer outside 25 to 50 mm	2 nos.
44.	Micrometer outside 50 to 75 mm	1 no.
45.	Micrometer outside 75 to 100 mm	1 no.
46.	Internal Micrometer 25 to 150 mm with extension Rods.	1 no.
47.	Depth Gauge Micrometer with extension rods to 150 mm with 70 mm Base	1 no.
A 48.	Indicating Micrometer 0.25 mm range, graduation, 01" mm graduation of dial 0.001 mm range of dial + 0.02	1 No.
49	Oil Stone Carborandum, Coarse on one side and fine on the other 200 x 50 x 25 mm	2 Nos.
50	Oil Stone Carborandum, Coarse on one side and fine on other slip 100 x 12 mm triangular.	2 Nos.
51	Oil Stone Carborandum, Coarse on one side and fine on other slip 100 x 18 mm triangular	2 Nos.
52.	Try Square, Engineer's 100 mm blade	2 Nos.
53.	Straight Edge Engineer's 300 x 50 x 12 mm bevelled edge.	1 No.
54.	Screw Driver 200 mm blade	2 Nos.
55.	Screw Driver 300 mm blade	2 Nos.
56	Spanner D.E. open jaw 3 to 18 mm by 3 mm	2 Sets
57	Scraper Flat 25 x 200 mm with handle	2 Nos.
58	Scraper Half round 75 x 12 x 200 mm with handle	2 Nos.
59	Scraper Triangular 62 x 9 x 200 mm with handle	2 Nos.

60	Techometer with male and female rubber attachments (upto 0-10,000 RPM)	1 No.
61.	Table Chuck 75 mm Jaw Swivel Base 200 mm dia. 3 Jaw with bolting arrangement and graduated in degrees	1 No.
62.	Vices, Machine Plain 150 Jaws x 100 mm openings	2 Nos.
63.	Vices, Machine, Swivelling Base 150 mm x 100 mm	2 Nos.
64.	Universal Machine Vice 100 mm for Grinding	2 Nos.
65.	Wheel Dressers, Steel Type (Huntington) (Large)	2 Nos.
66.	Wheel Dressers, Steel (Huntington type Small)	3Nos.
67	Radius Truing Attachment for surface grinding machine	1No.
68	Radius Truing Attachment for cylindrical grinding machine.	1No.
69	Angle Truing Attachment for surface grinding machine.	1 No.
70	Demagnetizer Chuck	1 No.
M 71	Centre Punch 150 x 6 mm dia	4 Nos.
72	Reamer Adjustable 6 to 16 x 1.5 mm	1 Set
73.	Surface Plate 60 x 60 cms	1 No.
74.	Marking Table 90 x 60 x 90 cms	1 No.
A 75.	Hand Drill 6 mm	1 Set
A 76	Taps and Dies complete set in box (Metric)	1 Set
A 77	Taps and Dies set B.A.B.S.F.B.S.W. and American	1 Set
A 78.	Drill Twist (Straight Shank) 1/8" to 1/2" by 1/64"	1 Set
A 79.	Drill Twist (Metric) 3 mm to 12 mm, in step of 1 mm	1 Set
A 80.	Set of Sockets Morse taper (0-1, 1-2 and 2-3)	1 Set
A 81.	Drill Chuck 0 to 12 mm Morse Taper	1 No.
82.	Combination Drill (Centering)	2 Nos.
83.	Screw Pitch Gauge	2 Nos.
84.	Working Benches 340 x 120 x 75 cms with 4 bench vices, 125 mm jaw	1 No.
S 85.	Fire Extinguisher	1 No.
S 86.	Fire Buckets with stand	4 Nos.
87.	Steel lockers with 6 drawers	2 Nos.
88.	Metal Rack 180 x 150 x 45 cms	1 No.
89.	Desk	1 No.
90.	Stool	1 No.
91.	Black Board with Easel	1 No.
A 92.	Magnifying Glass with surface illuminator	1 No.
A 93.	CMTI surface finish standards (in Bakelite)	1 No.
A 94.	Adjustable Wrench 250 mm size	1 No.
A 95.	Hammer (Nylon face) 30 mm	4 Nos.
A 96.	Grease Gun	2 Nos.
A 97.	Magnetic V-Block with push button switch	1 Set
A 98.	Magnetic V-Block base for Dial Indicator 75 x 75 x 100 mm	2 Nos.
A 99.	Diamond Dresser Cluster type	2 Nos.
A 100.	Adjustable Parallel Clamps (Hardened and ground) 100 mm long	2 Pairs
101.	Granite Stone Surface Plate Grade A 600 x 500 x 1000 mm	1 No.
102.	Static balancing stand for grinding wheel	1 No.
103.	Soft Board for display 1.25 mm x 1.85 mm x 10 mm thick	1 No.
A 104.	Dial Test Indicator-Lever type-long point	2 Nos.
A 105.	Magnetic Stand Flexible type base 60 mm x 47.5 mm Magnetic Power 75 kg. ON-OFF Lever control	2 Nos.
A 106.	Cutter Clearance Gauge to Suit Clearance all cutter diameters angle 0"-	1 Set

	30".	
M 107.	Glass Show Case for display of jobs 450 mm x 600 x 850mm	1 No.
Desirable:-		
1.	Shadeograph projector with diascopic and epidiascopic projection, magnification 50, 100, 200, rotary screen 1 minute accuracy and centering, attachment.	1 No.

C: GENERAL MACHINERY

SL. No.	Description of Machinery	Quantity
S 1.	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.
S 2.	Drilling machine pillar 0-12 capacity	1 No.
S 3.	Grinding machine external cylindrical fully motorized and supplied with face plates and driving dogs, 3-jaw self centering chuck 4- jaw independent chuck tail stock assorted centers, stud pumps tank all guards 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)	2 Nos.
S 4.	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 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.
S 5.	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 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.
S 6.	Tool and cutter grinding machine of 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 attachment).	2 Nos.
S 7.	Lapping machine with motor and chuck 132 cm dia.	1 No.

NOTE :-

(1) No additional items are required to be provided for the batches working in the second shift except the items under the trainees tool kit and lockers.

(2) Additional number of items marked 'S' are not required to be provided for additional number of batches.

(3) Items marked 'A' are to be obtained from the main store.

(4) The specifications of the items in the above list have been given in metric units. The items which are available in the market nearest to the specifications as mentioned above if not available as

prescribed, should be produced. Measuring instruments such as steel rules which have graduation both in English and Metric units may be produced, if possible.
(5) Simple hand tools for fitting etc. such as hammers, scribing blocks, V block parallel block, angle plate Allen keys centre punch, oil cans etc. mentioned in the above list and marked 'M' may be made in the Institute as far as possible.

D : ADDITIONAL LIST OF TOOLS AND EQUIPMENTS REQUIRED FOR 3RD AND 4TH SEMESTERS
(For a batch of 15 trainees)

Sr. No.	Description	Quantity
1.	2.	3.
GENERAL MACHINERY		
1.	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 Nos.
2.	Small type hand honing machine with motors sand and bracket and with sets of different types of honing stones and other accessories.	1 nos.
3.	Lathe machine with taper turning attachment 4-jaw chuck and 3-jaw chuck.	1 nos.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: MACHINIST (GRINDER)

LIST OF TOOLS& EQUIPMENTS FOR 16 APPRENTICES

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

2) Infrastructure:

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity (indicative)
1.	Draughtsman drawing instrument box	16 Nos.
2.	Set square celluloid 45^0 (250 X 1.5 mm)	16 Nos.
3.	Set square celluloid 30^0-60^0 (250 X 1.5 mm)	16 Nos.
4.	Mini drafter	16 Nos.
5.	Drawing board (700mm x500 mm) IS: 1444	16 Nos.

B : FURNITURE REQUIRED

Sl. No.	Name of the items	Quantity (indicative)
1	Drawing Board	16 Nos.
2	Models : Solid & cut section	as required
3	Drawing Table for trainees	as required
4	Stool for trainees	as required
5	Cupboard (big)	01
6	White Board (size: 8ft. x 4ft.)	01
7	Trainer's Table	01
8	Trainer's Chair	01

ANNEXURE – II

INFRASTRUCTURE FOR ON-JOB TRAINING

TRADE: MACHINIST (GRINDER)

For Batch of 16 APPRENTICES

Actual training will depend on the existing facilities available in the establishments. However, the industry should ensure that the broad skills defined against On-Job Training part (i.e. 9 months + 9 months) are imparted. In case of any short fall the concern industry may impart the training in cluster mode/ any other industry/ at ITI.

ANNEXURE-III

GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

1. Due care to be taken for proper & inclusive delivery among the batch. Some of the following some method of delivery may be adopted:

A) LECTURE
B) LESSON
C) DEMONSTRATION
D) PRACTICE
E) GROUP DISCUSSION
F) DISCUSSION WITH PEER GROUP
G) PROJECT WORK
H) INDUSTRIAL VISIT

2. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. may be adopted.

3. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.