CURRICULUM

FOR THE TRADE OF

MECHANIC MACHINE TOOL MAINTENANCE

UNDER

APPRENTICESHIP TRAINING SCHEME

सत्यमेव जयते
Government of India

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

CONTENTS

1. ACKNOWLEDGEMENT

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

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

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 **Mechanic Machine Tool Maintenance** trade)

1. It will help the trainees to be innovative and know about common things like performing routine maintenance and determining when and what kind of maintenance is needed as per the situation.
2. The training will develop the capability of installation like installing equipment, machines or programs to meet specifications.
3. The training will develop the listening skills such as listening to what other people are saying and asking questions as appropriate.
4. It will enhance the ability to work on dismantle and assemble of various valves, test the accuracy of machine tools.
5. It will enhance the performance of repair on machinery, dovetail slides, and assemble with location dowel pins. Stud and bolts.
6. The training will develop the testing of machine tools: Factors affecting performance of machine tools, machine tool-work piece-Fixture systems, reasons for errors in machining.
7. The training will develop to understand the various types of Foundations of machine tools, Erection and Leveling, Grouting.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

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

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

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

Reference NCO & NOS:

i) **NCO-2004 : 8281.55**
ii) **NCO-2004: 8281.10**

5. GENERAL INFORMATION

1. **Name of the Trade** **: MACHANIC MACHINE TOOL MAINTENANCE**

2. **N.C.O. Code No.** **: NCO-2004:** 8281.55, 8281.10

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 class 10th Exam 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 **MMTM**

Note: Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.

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** : **MACHANIC MACHINE TOOL MAINTENANCE**
2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)
3) **Batch size** : 20
4) **Power Norms** : 17 KW for Workshop
5) **Space Norms** : 192 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 **Mechanic Machine Tool Maintenance** 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. Define environment, environment Pollution, Pollutants, type of Pollution (Air pollution, water pollution, soil pollution noise pollution, thermal pollution, radiation. Global warming its causes and remedies. Industrial Waste its types, sources and waste Management.
2.	Identification of tools & equipments as per desired specifications for marking & 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.	Hand tools and its importance, steel rule, Try square, chisel, surface gauge and care & maintenance, Hacksaw frame, blades. Classification and types of chisels, files & uses, vices - its constructions and uses. Hammers and its types. Related safety. Marking block, Steel rule, and calipers-different types and uses. Combination set-its components and uses. Hacksaw blade, Hacksaw frame and its types. Drill bits- parts, Types & uses.

	Filing Flat surfaces, Tee shape job, flat type polygon, checking with steel rule and Try square. Marking and Drilling holes on flat pieces. Tapping as per simple drawing.	Introduction to Hand Taps & Dies and their types, applications, care and maintenance. Familiar with tap and drill size, Thread Terminology. Use of vernier caliper and its parts, construction, principle & reading, use & care.
3.	Understand and usage of different measuring instruments e.g. bore gauge, dial indicator, edge finder. Checking and setting of Vernier calipers, vernier height gauge &vernier bevel protractor. Filing flat, square, steps and contour surfaces to an accuracy of 0.4 mm	Linear measurements & its units. Classification, construction, materials and functional detail of following basic measuring and marking tools : - • Steel Rule • Calipers(Inside & outside), • Divider, Trammel • Try Square • Marking Punch Measuring Instruments viz., Vernier calipers, vernier height gauge &vernier bevel protractor.
4	Chipping practice on flat surface, slots & oil grooves, and chamfer at different angle on MS plate. Scraping practice on curved surfaces. Preparation of flat surfaces and scraping practice on flat surface taking impression on face high spots using prussian blue sharpening by diamond dresser & wheel and lapping stone.	Precision Measuring Instruments: Concept of precision & accuracy Micrometer (outside, inside and depth) – working principle, construction, use & care, calculation of least count Classification, construction and functional detail of following marking devices- Surface plate, angle plate, marking block and V-Block. **Scrapers**: Introduction, its types, material and use.
5	Demo & practice of different operation of lathe machine, mounting and dismantling of different turning tools on machines. Different practical exercises with different accuracy levels. Identification of various parts of Drilling machines. Use of drilling machine for drilling through & blind holes, counter boring and counter sinking on mild steel (MS) flat. Drilling on cylindrical surface. Reaming of drilled hole. Making internal & external thread by Taps & Dies.	Identification of different parts, accessories, attachments', operations and tools used in drilling machines. Types of drilling machines like bench, pillar & radial drilling machines and their constructional details. Types of drilling operations, calculation of cutting speed, feed & drilling time. Introduction to lathe, identification of different parts, accessories, attachments', operations and tools used in lathe machines. Basic mechanism of metal cutting and process parameters, their effect on product quality.
6.	Demo & practice of different operation on milling machine, mounting and dismantling of different milling cutters on milling machines. Different	Introduction to milling machine identification of different parts, accessories, attachments', operations and tools used in milling machines.

	practical exercises with different accuracy levels. Grinding practice of Drill.	**Fasteners:** Introduction to fasteners, screw threads, related terminology and specification. Keys- types & use, (parallel, sunk, tangential, gib head, woodruff, key ways.) Types of nuts, bolts, studs, locking devices for nut, wrench and spanner, pliers, screw drivers, Circlip, split pin, washers, spring washer. Concept of torque & torque wrench. Different types of rivets and their applications.
7.	Filing & fitting mating components by filing within an accuracy of ± 0.10 mm & angular 1°	Surface finish - importance, symbol, measuring techniques. Lapping & honing process. **Gauges:** Classification and uses of Sine bar, Slip gauge, Limit gauge, Feeler gauge, thread gauge, screw pitch gauge, taper gauge. **Tolerances & interchangeability** -Definition and its necessity, basic size, actual size, limits, deviation, Tolerance, allowance, clearance, interference, Fits- definition, types, description with sketches. Method of expressing Tolerance as per BIS, Hole and Shaft basis (BIS standard). Related calculation on Limit, Fit and Tolerance.
8-9.	Demo & practice of different operation on grinding machines, mounting and dismantling of grinding wheels on grinding machines. Different practical exercises with different accuracy levels. Demo & practice of different operation on Shaper machine, mounting and dismantling of tools & jobs on Shaper machine. Different practical exercises with different accuracy levels.	Introduction surface and cylindrical grinding machine, identification of different parts, accessories, attachments', operations and tools used in grinding machines. Selection of grinding wheels, balancing and mounting of grinding wheels. **Taps & Dies**: Classification, construction, material and functional detail of Taps & Dies. Pedestal grinder – Introduction, care & use. Procedure of wheel mounting & wheel dressing. Related hazards, risk and precautions.
10.	Demo and practical's on different welding techniques.	Definition and application of welding. Different types of basic welding and explain the basic welding techniques and execute different welding
11.	Identify different basic electrical & electronic components and test their functioning.	Basic Electricals: Safety in electrical shop. Measurement of current, voltage, resistance and power. Use of multimeters. Basic principles of DC generators and motors,

		Alternators and AC motors and transformers. Various types of switches, circuit breakers, fuses, lamps, proximity switches, relays and contactor in electrical circuits. **BASIC ELECTRONICS** Introduction to electronics and its industrial applications. Different electronic components viz., resistor, capacitors & inductor and their function.
12.	Installing drive belts, Measuring and adjusting the belt tension. Related hazards, risk and precautions while working.	**Belts-** Belt types (Flat and V) and specifications. Pulleys used for belt drive. Installation, Alignment of belts. Problems related to belts(Creep and slip) Belt maintenance. Sheave alignment, Chain drive- Roller chain, Silent chain, alignment of sprockets, and maintenance of chain drive.
13.	**Revision & Internal Assessment**	

B. Block –II
Basic Training

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

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

		Warning & protective devices used in centralized lubrication system (Pressure switch, temperature gauge, level indicator and relief valve.) Lubrication fittings. Storage and handling, Contamination control. Leakage prevention-Shaft seals, sealing devices and "O" rings.
7.	Perform repairs of worn out parts of machine tools. Practice soldering. Disassembling & assembling of bearing.	MACHINE FOUNDATION Methods employed for installation & erection of precision & heavy duty machines. Location & excavation for foundation. Different types of foundations – foundation bolts, structural, reinforced, wooden, isolated foundations. Breakdown Maintenance, Preventive Maintenance, Predictive Maintenance & Concepts of TPM, OEE.(without calculations) Difference between breakdown and preventive maintenance – Its importance in productivity, types.
8.	Dismantling & Assembly of various parts &sub assemblies of milling machine such as head stock, gear box, lead screw, table, etc	**Leveling** Definition and importance of leveling. Types of levels- Spirit level, Water level, Dumpy level, Method of leveling. Preparation of packing and shim. **Alignment:** Definition and importance of alignment, Types of misalignment, Planes of misalignment, Shaft vs. coupling alignment, Actions to be taken before alignment, Concept of axial float, Concept of Indicator sag, Dial Test Indicator, Methods of alignment - Rim and Face readings on Stationary Machine, Rim and Face reading on machine to be seamed. Geometrical Alignment of Machine. **Balancing** Understanding importance of balancing and reasons of unbalance. Type of unbalance. Method of static balancing and its correction -Adding and removing mass -Mass centering.
9.	Identification of various types of fans, Blowers, their parts. Dismantling, cleaning and assembly of parts. Identification of various types of compressors, their parts. Starting and stopping of compressors Cleaning and changing of filters	Fan & Blowers: Types and working principle Constructional detail of Fans & Blowers. Starting and stopping of Fans and Blowers Different parts of Fans & Blowers Concept of surge. Preventive & scheduled maintenance.

	Preventive & schedule maintenance of Blower & Compressor	Compressors: Compression theory, Types of compressors Constructional detail of compressors, working mechanism Different parts and their function. Loading unloading system Concept of air dryer. Preventive & schedule maintenance.
10.	Identification of various types of centrifugal pumps, their parts. Overhauling of pump. Priming of pump, Fitting gland packing. Starting and stopping of pumps. Trouble shooting in pump operation. Preventive and schedule maintenance of pumps.	Centrifugal Pump, Fan, Blower and Compressor: - Function of pump. Types and working principle of centrifugal pump. Constructional detail of pump Starting and stopping Pump performance and characteristics. Capitation & aeration. Preventive & schedule maintenance of pumps. Gland packing changing procedure. Concept of Mechanical seal Trouble shooting in pump.
11-12.	Revision of Dismantle, inspect and do minor repairs and assemble machine tools such as drill, shaper, lathe and power saw machines. Practice of dismantling & assembly of feed units of milling, grinding etc.	Introduction to CNC lathe and machining center, constructional details, Mechanical, electrical and Electronic elements of CNC machine, CNC Part program. Study of hydraulic diagram, hydraulics valves etc. Programmable logic controller (PLC) – General concept of working, Relay Logic Control vs. PLC, Block diagram, applications.
13.	**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** : **MECHANIC MACHINE TOOL MAINTENACE**

2) **Batch size** : a) Apprentice selection as per Apprenticeship guidelines.
b) Maximum 20 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 Mechanic **Machine Tool Maintenance** with three year post qualification experience in the relevant field.

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

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

B. BLOCK – II (09 months)

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

5. Conduct the preventive maintenance, overhaul and check the functionality of the Hydraulic & Pneumatic systems of machine tools. Perform fault finding and attend break downs of different hydraulic and pneumatic machineries / equipment's viz., hydraulic press, Power hammer in the shop floor.
6. Referring the machine maintenance manual and retrieve the spare part details (for ordering purpose).
7. Specification systems for standard mechanical elements e.g. bearings, seals, V Belts, gear, fasteners and locking fasteners, springs, keys and pins.
8. Interpretation and preparation of dismantling and assembly plan and sequence for different machine elements.
9. Drawing and drafting of machine part as per requirement (in case of worn out/ modification)
10. Understanding of Statistical Process Control (SPC) and machine capability indices.
11. Perform repairs of worn out parts of machine tools and check their function ability.
12. Perform Inspection & Condition Monitoring of different types of machine tools used in shop floor.
13. Perform applications of resistor, capacitor conductor components Testing & measurement of their values and solddering and desoldering of component on printed circuit boards (**PCB)** precautions to be taken while soldering on PCB.
14. Trouble shooting of mechanical elements in PLC with case studies.
15. Perform overhauling, trouble shooting of various types of pumps, their parts.
16. Perform Practical Demo on CNC lathe and CNC machining centre operation, its essential parts. Functioning of each part.
17. Diagnose and fault finding on CNC lathe and CNC machining centre and perform mechanical maintenance work in CNC machines.
18. Conducting overhaul of compressors Cleaning and changing of filters Preventive & schedule maintenance of Blower & Compressor.
19. 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. Structural Fabrication like bridges, Roof structures, Building & construction.
3. Automobile and allied industries
4. Service industries like road transportation and Railways.
5. Ship building and repair
6. Infrastructure and defence organisations
7. In public sector industries (Central and State) and private industries in India & abroad.
8. Self employment

ANNEXURE – I

TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: MECHANIC MACHINE TOOL MAINTENANCE

LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

A1. TRAINEES TOOL KIT

Sl. No.	Name of tools and equipments	Quantity
1.	Steel Rule 15 cm both side Graduated in Metric & English.	20 nos.
2.	Center punch 100 mm	20 nos.
3.	File flat 2nd cut 250 mm	20 nos.
4.	File flat bastard 350 mm	20 nos.
5.	File flat smooth 200 mm	20 nos.

A2. TRAINEE TOOL KIT (ONE FOR GROUP OF 5 TRAINEES)

Sl. No.	Name of tools and equipments	Quantity
1.	Hermaphrodite Caliper 150 mm	4 nos.
2.	Try Square 150 mm	4 nos.
3.	Hack Saw frame adjustable 250-300 mm with blades.	4 nos.
4.	Hammer ball peen 400 gm with handle.	4 nos.
5.	Cold Chisel 20 x200 mm	4 nos.
6.	Cross Chisel 10x150 mm	4 nos.
7.	Half Round Chisel 10x150 mm	4 nos.
8.	Diamond point Chisel 10x150 mm	4 nos.
9.	File Half round 2nd cut 250 mm	4 nos.
10.	File triangular smooth 200 mm	4 nos.
11.	File round smooth 200 mm	4 nos.
12.	File square smooth 200 mm	4 nos.
13.	Round nose pliers 200 mm	4 nos.
14.	Combination pliers 200 mm	4 nos.
15.	Scraper A 250 mm (Bearing)	4 nos.
16.	Scraper B 250 mm (Triangular)	4 nos.
17.	Scraper D 250 mm (Half Round)	4 nos.
18.	Spindle blade screw driver 100 mm	4 nos.
19.	Allen keys 2 to 16 mm (Hexagonal)	4 nos.

20.	Card file	4 nos.

B. TOOLS AND EQUIPMENT FOR MAINTENANCE SHOP

Sl. No.	Name of tools and equipments	Quantity
1	Tap and die set M6, M8, M10, M12, M16, M20& M25 with necessary tap wrench and die holder.	1 each
2	Spanner socket set of 25 pieces (10 to 25, 27, 30, 32, mm = 18 pcs and assorted = 7 nos.)	1no.
3	Hammer soft (faced 30 mm dia.) plastic tipped.	As required
4	Pipe wrench 450	As required
5	Chain pipe wrench 650	As required
6	Telescopic gauges 13 mm to 300 mm.	As required
7	Tap Extractor	1 no.
8	Linear Actuator (Differential and non-differential)	1 each
9	Cut section model of Pneumatic vales	1 no.
10	Vibrometer	As required
11	Flow Detector	1 no.
12	Magnetic crack detector	1 no.
13	Engineers Stethoscope	As required
14	Stud Extractor	1 no.
15	Tool picker collate type	As required
16	Tool picker magnetic type	As required
17	Magnifying Glass 75 mm	1 no.
18	Pin spanner set	1set
19	Hand keyway breacher	As required
20	C.I. Surface plate 400 x 400 mm with stand and cover	As required
21	Head lamp	1 no.
22	Bearing and gear tester	As required
23	Master test bars (Different sizes)	1 no.
24	Spirit Level 150 mm, accuracy 0.02 mm / 1000 mm	2 nos.
25	3 Cells Torch	2 nos.
26	Gasket Hollow punches 5, 6, 8, 10, 12, 19, 25 mm dia.	1 each
27	Bar type Torque Wrench	1 no
28	Cam lock type Screw Driver	1 no
29	Flaring tools	2 no
30	Tube Expander up to 62 mm	2 set
31	Circlip Pliers (inside, outside and straight)	1 each
32	Sledge hammer 5 Kgs.	1 no
33	Viscometer	1 no.
34	Vernier height gauge 300 mm	1 no.
35	Maintenance tool kit trolley of 1200 x 800 x1200 mm (L x W x H)	As required
36	Steel lockers for 20 trainees	2 nos.
37	Steel cupboard 180 cm x 60 cm x 45 cm	6 nos.
38	Workbench 240 cm x 120 cm x 75 cm (Each bench fitted with 4 vices)	5 nos.

39	Bench Vice with 100 mm jaw	20 nos.
40	Letter punch 5 mm set	1 set
41	Number punch 5mm set	1 set
42	Deep cutting hacksaw frame 300 mm	1 no.
43	Bearing puller	1 no

C. PRECISION INSTRUMENTS:

Sl. No.	Name of tools and equipments	Quantity
1	Vernier Bevel protractor with 150 mm blade	1 no.
2	Vernier caliper 200 mm with Inside and depth measurements	2 nos.
3	Dial vernier caliper 200 mm, with 0.02 mm least count	1 no.
4	Optical Bevel protractor	1 no.
5	Outside micrometer 0 to 25mm	1 no.
6	Outside micrometer 25 to 50 mm	1 no.
7	Outside micrometer 50 to 75 mm	1 no.
8	Combination set with 300 mm blade centre head, square head and protector head.	1 no.
9	Sine bar 200 mm	1 no.
10	Slip Gauge Box (workshop grade) - 87 pieces per set	1 no.
11	Inside micrometer 50 mm to 200mm, 0.01 mm least count with six extension rod.	1 no.
12	Gear tooth Micrometer (metric)	1 no.
13	Bevel gauge 200	1 no.
14	Dial test indicator – Plunger type-Range 0-10 mm , Graduation 0.01 mm & 0.001mm Reading 0-10 with revolution counter (complete with clamping devices and magnetic stand)	1 set
15	Dial test indicator – Puppitast type-Range 0-10 mm , Graduation 0.01 mm & 0.001 mm. Reading 0-10 with revolution counter (complete with clamping devices and magnetic stand)	1 set
16	Feeler gauge	1 no.
17	Radius gauge 1 to 25 mm radius	1 no.
18	Screw pitch gauge for metric, standard & fine pitches. BSP & BSW pitches (0.25 to 6 mm)	1 no.
19	Center gauge 55º x 47½º	1 no.
20	Center gauge 60º	1 no.
21	Plug gaugeMorse taper No.1, 2, 3, 4,	1 set
22	Ring gauge Morse taper No.1, 2, 3, 4,	1 set
23	Ring gauge Ø20mm (Go and No Go)	1 no.
24	Limit plug gauges Ø20mm	1 no.
25	Wire gauges	1 no.
26	Bore gauge with dial indicator (1 mm range, 0-0.01 mm graduation)-Range of bore gauge 18-150 mm)	1 no.
27	Straight edge 485 mm to 1445 mm	1 set
28	Bearing fitting tool	1 set
29	Multimeter	2 Nos.
30	Tong tester	1 No.
31	Megger	1 No.

32	Wire stripper cum cutter	1 No.
33	Crimping Tool	1 No.

D. LATHE TOOLS:

Sl. No.	Name of tools	Quantity
1	Reduction sleeve and extension socket.	As required
2	Centre drills 3, 4 and 5 mm (Consumable)	2 nos. each
3	Revolving centre with arbor	As required
4	Knurling tool with holder (straight, cross, diamond)	1 each
5	Dog carrier	As required
6	Oil can pressure feed	As required
7	Tool holder (straight) to suit 6 & 8 mm sq. bit size	As required
8	H.S.S. tool bits 6 mm, 8 mm sq. x100 mm length (consumable)	As required

E. MILLING MACHINE TOOLS:

Sl. No.	Name of tools	Quantity
1	Cylindrical milling cutter Ø 63 x 70 x Ø 27 mm	1 no.
2	Side and face cutter Ø 80 x 10 X Ø 27 mm	1 no
3	Slitting Saw cutter Ø 100 x 6 X Ø 27 mm	1 no.
4	Slitting Saw cutter Ø 75 x 3 X Ø 27 mm	1 no.
5	'T' slot cutter with parallel shank- Ø 17.5 x 8 mm width x dia. of shank 8 mm	1 no.
6	Woodruff key seating cutters A 13.5x3, A16x4	1 each
7	Parallel shank end mill Ø 5 mm, Ø 6 mm, Ø 8mm, Ø 10 mm and Ø 12 mm	1 each
8	Disc type form milling cutter (involutes form -1.5 & 2 module, 20° pressure angle)	As required
9	Scribing block universal 300mm	As required
10	V-Block-Approx 65x65x80 mm with clamping capacity of 50 mm with clamps	1 set each
11	D.E spanners 3-4 , 6-8, 10-12, 13-14, 15-16, 18-19, 20-22, 24-26 (8 spanners)	1 set
12	Angle plate-adjustable 250x250x300 mm	1 no.
13	Twist Drill Parallel Shank Ø 4 mm to Ø 12 mm in steps of 0.5 mm	1 each
14	Grinding wheel dresser (diamond dresser) with holder 1.5 carat diamond	2 nos.
15	C – clamp- 50 mm & 75 mm	1 each
16	Hand reamer 6 to 16 mm in steps of 1 mm	1 each
17	Machine reamer 6 to 16 in steps of 1 mm	1 each

F. GENERAL MACHINERIES:

Sl. No.	Name of tools and equipments	Quantity

1.	Lathe all gear head type, with Centre height of 150 mm, Gap bed, between centers 1000 mm (with 3 jaw and 4 jaw chuck, coolant equipments).	2 nos
2.	Universal Milling machine	1no
3.	Surface grinding machine wheel dia 180 mm (or near) reciprocating table, longitudinal table traverse 200mm (or near) full motorized supplied with magnetic chuck 250 X120mm and necessary accessories.	1no
4.	Drilling machine pillar type 20mm capacity.	1no
5.	Double ended Pedestal Grinder with 178 mm wheels(one fine and one rough)-motorized with twist drill grinding attachment	1no
6.	Flexible Hand Grinder 100 mm dia – light duty	1no
7.	Portable Drilling machine 6 mm capacity.	1no
8.	Shaping Machine 450 mm stroke (motorized) with all attachments	1no
9.	Pipe bending machine	1no
10	Hydraulic trainer with necessary elements for different machine circuit with all types of transparent valves and pressure gauge, reservoir etc.	1 set
11	Pneumatic trainer with necessary elements for demonstration different machine circuit with all types of valves, pressure gauge and compressor etc.	1 set

G. OLD MACHINES FOR JOB WORK (REPAIR & RECONDITIONING):

Sl. No.	Name of tools and equipments	Quantity
1.	Old Centre lathe	1no
2.	Old Milling Machine (Universal)	1no
3.	Old Grinding Machine (Universal)	1no
4.	Old Shaping Machine	1no
5.	Old Gear Box (any type)	1no
6.	Revolving Centre	1no
7	Old hydraulic power pack with hydraulic cylinder	1 no
8	Old hydraulic power press	1 no
9	Old Gear pump	1 no.
10	Old Vane pump fixed and variable delivery	1each
11	Old Piston pump (Radial & Axial)	1each

H. WELDING WORK:

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

1. GAS WELDING -

Sl. No.	Name of tools and equipments	Quantity
1.	Oxy-acetylene welding Cylinder Trolley	1 no.
2.	Welding hose P.V.C. flexible internal dia. 6 mm (Blue and red)	5m
3.	Hose coupling Nipples	2 nos.
4.	Hose Protractor	2 nos.
5.	Double stage Pressure regulator for Oxygen and Acetylene	1no. each
6.	High Pressure blow pipe with tips	1 no.
7.	Gas cutting torch with cutting tips	1 no
8.	Welding gloves pair (Leather)	1 pair
9.	Goggles (4A) for Gas. Welding	4 nos.
10.	Spark lighter	2 nos.
11.	Spindle key	1 no.

12.	Gas Welding table with fire bricks.	1 no.

2. ARC WELDING -

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

Sl. No.	Name of tools and equipments	Quantity
1.	Welding Machine DC or AC, (Single phase / 3 phase), 150 – 300 Amps capacity with all accessories	1 no.

1. ERECTION TOOLS :

Sl. No.	Name of tools and equipments	Quantity
1.	Foundation bolts (different types)	1each.
2.	Plumb bob	1 no.
3.	Square Box Wrenches	1 no
4.	Square T Wrenches	1 no
5.	Engineers square 700 mm	1 no
6.	Threaded Fastener B Type	1 no
7.	Threaded Fastener C Type	1 no
8.	Threaded Fastener F Type	1 no
9.	Hoisting Equipment: chain pulley, steel slings, rope, belt, tackles	1 set

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: MECHANIC MACHINE TOOL MAINTENANCE

LIST OF TOOLS& EQUIPMENTS FOR 20 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	20 Nos.
2.	Set square celluloid 45^0 (250 X 1.5 mm)	20 Nos.
3.	Set square celluloid 30^0-60^0 (250 X 1.5 mm)	20 Nos.
4.	Mini drafter	20 Nos.
5.	Drawing board (700mm x500 mm) IS: 1444	20 Nos.

B : FURNITURE REQUIRED

Sl. No.	Name of the items	Quantity (indicative)
1	Drawing Board	20 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: MECHANIC MACHINE TOOL MAINTENANCE

For Batch of 20 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.