CURRICULUM

FOR THE TRADE OF

MACHINIST

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

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Remarks
1.	N. Nath, ADT	CSTARI, Kolkata	Expert
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4.	Madhusudan Karmakar, V.I.	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 **Machinist** 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. It helps determine the cutting path, speed of the cut and the feed rate, and the programmer converts path, speed, and feed information into a set of instructions for the CNC machine tool.
12. Able to repair or make new parts for existing machinery.
13. It will enhance to attain promotion or become specialized in an area like making tools and die, mold-making, maintenance machining or CNC programming.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

Machinist General operates various types of power driven metal cutting or grinding machines for cutting and grinding metal. Studies drawings or measures out sample with appropriate measuring instruments to note different dimensions and sequence of operations required. Selects metal piece and marks it or gets it marked for machining operations required. Fastens metal in chuck, jig or other fixture and respective tool or cutter, according to sequence of operation, on appropriate machine (lathe, shaper, milling, slotting, drilling, grinding).Checks machine setting or sets it for stipulated machine operations. Selects machine feed and speed and starts machine. Controls flow of coolant (cutting lubricant) and manipulates hand wheels or applies automatic controls to feed tool to metal or metal to tool. Observes cutting or grinding both from marking and machine readings, checks for dimensions as necessary and removes parts when machining is completed, checks completed part with measuring instruments and gauges to ensure prescribed accuracy. Makes adjustments if necessary and repeats operations, as required, on same or other machines. May assist in setting up machine for repetitive work, change tools, make simple adjustments, clean and oil machine. Demonstrate the operation of CNC Machining Center (3-axes) and producing components as per drawing by preparing part programmes.

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:

i) **NCO-2004: 8211.10**
ii) **NCO-2004: 8211.15**
iii) **NCO-2004: 8211.22**
iv) **NCO-2004: 8211.28**
v) **NCO-2004: 8211.30**
vi) **NCO-2004: 8211.32**
vii) **NCO-2004: 8211.36**
viii) **NCO-2004: 8211.38**

5. GENERAL INFORMATION

1. **Name of the Trade** **: MACHINIST**

2. **N.C.O. Code No.** : **NCO-2004:** 8211.10, 8211.15, 8211.22, 8211.28, 8211.30, 8211.32, 8211.36, 8211.38

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**

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**
2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)
3) **Batch size** : 16
4) **Power Norms** : 20 KW for Workshop
5) **Space Norms** : 130 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** 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. Chipping flat surfaces and grinding various angles to chisels, filing flat surface. Grooving with Hammer and chisel. 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. Fitting male and female square piece to close limit. Application of vernier caliper in making job.	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. Hacksaw blade, Hacksaw frame and its types. Drill bits- parts, Types & uses. Introduction to Hand Taps & Dies and their types, applications, care and maintenance. Familiar with tap and drill size, Thread Terminology. Use of vernier caliper and its parts, construction, principle & reading, use & care. Heat treatment process Annealing, Normalising, Tempering, Hardening, case hardening and its importance.
3.	Introduction to Shaping machine and its construction. Setting of strokes, tools, job on table. Safety points to be observed while working on a shaper. Setting of vice, setting of block on vice checking accuracy. Machining of Rectangular, Hexagonal block, steps, with the use of Basic tools as per sketch checking with caliper & steel rule, angle protractor.	Outside micrometer, its types and construction, parts, reading use, care and maintenance. Study about Depth gauge, micrometers and dial test indicator - their parts and construction. Introduction of shaper, types, classification, General principles of power transmission on shaping mechanism. Shaping parts, construction use of parts, quick return mechanism ratio etc. Various tools of shaping machine and their angles and importance of angles.

4	Shaping "V" blocks with slides, measurement of 'V' groove with vernier bevel protractor, measurement of slots by vernier caliper with 0.02 mm accuracy. Shaping Tee slots, shaping angular surfaces. Cutting of external keyway on shaper.	Various methods of holding jobs, use of clamps, nuts & bolts V- blocks, angle plates shaping operations, their importance. Tool head - its parts and application, function of each part of tool head. Shaping tools and types. Speed, feed, depth of cut.
5.	General introduction to slotting. Safety points to be observed while working on a slotter. Slotting a rectangular job checking and measuring with gauges & precision measuring instruments.	Slotter-principle, construction, details, driving mechanism, quick return motion and speed ratio. Safety precaution comparative study with a shaping machine. Classification of slotting machine. Job holding devices-vice, clamps, V-block, parallel block etc. Slotting tools different types of work tool angles comparison of tool shape with that of shaper.
6.	Practice on slotting key ways on pulley-Internal and external slotting irregular shaped jobs having curved surfaces.	Use of tool with holder for internal operations. Precautions to be observed during slotting internal operations. Introduction to coolant & lubricant-difference between them, types and uses of each. Use of circular marks on the table for slotting curves. Introduction to Planing M/c. parts, types, constructions, details of Driving mechanism of planer, quick return motion etc.
8.	Holding of round job in an independent chuck and truing it. Holding the tool in a tool post, centering the job with the tool. Facing & drilling. Parallel turning between centers, parting off, chamfering using roughing, finishing and parting off tools.	Introduction to lathe. Its types, engine lathe construction, detail function of parts size and specification. Safety points to be observed while working on a lathe. Lathe tools their angles & uses. Driving mechanism, speed and feed mechanism & lathe accessories.

9.	Holding the job in three jaw chuck truing, centering facing. Step turning undercutting, knurling drilling and boring. Taper turning by swiveling compound rest, setting the compound rest to correct degree, checking the tool height, clamping the saddle for no longitudinal movement, checking up with precision instruments.	Chucks-different types of job holding devices on lathe and advantages of each type. Mounting and dismounting of chucks. Taper introduction, types and uses. Calculations of tapers. Measurement of taper by sine bar and slip gauges. Different thread forms their related dimensions and calculations screw cutting in a lathe.
10.	Introduction to milling machine, demonstration on working principle, setting of job, setting of cutter in arbor, setting of vice on table. Safety points to be observed while working on a milling machine. Sequence of milling six faces of a solid block. Checking the accuracy with the help of try-square scribing block and vernier height gauge. Step milling using side and face cutter checking with micrometer.	Milling machine importance of milling machine, types and specification of milling machine, driving and feed mechanism of milling machine. Classification & different types of milling cutters & their use. Parts and nomenclature. Vernier height gauge construction, graduations vernier setting & reading, vernier bevel protractor, construction graduation setting and reading. Care and maintenance of vernier height gauge and bevel protractor.
11.	Straddle and gang milling operations including up-milling and down milling. Milling concave and convex surfaces. Introduction to indexing head types, setting and aligning of indexing head with reference to job on milling machine. Milling square and hexagonal job by simple indexing method.	Different milling operations plain-face, angular, form, slot, gang and straddle milling etc. Up and down milling. Different types of milling attachments and their uses. Indexing-introduction & types. Indexing head-constructional details, function of indexing plates and the sector arms. Calculation for various types of indexing.

12.	Milling dovetail and 'T'slots both male & female matching each other. Milling of spur gear. Introduction to grinding machine surface grinder, cylindrical grinder. Driving and feed mechanism, job holding devices mounting of wheels. Wheel balancing & truing. Grinding of parallel and stepped jobs. Dressing of grinding wheels.	Gear introduction, use and type. Elements of a spur gear. Gear tooth of each forms types, merits and demerits of each. Spur gear calculations, curves and their uses. Selection of gear cutter type and form & various methods of checking gear and its parts. Grinding machine introduction types, specification, their parts and functions & uses. Safety points to be observed while working on a Grinding machine. Types of Abrasives and their uses, Glazing and loading of wheels. Explain the importance and necessity of quality.
13.	**Revision & Internal Assessment**	

B. Block –II
Basic Training

Week No.	Professional Skills	Professional Knowledge
1	Checking of alignment of lathe centers and their adjustments. Center drilling, step turning between centers recessing and chamfering & measurement with vernier caliper. Taper turning by taper turning attachment. Cutting V thread external and internal in a lathe. Checking up with screw pitch gauge. Cutting square thread external & internal on a lathe. Cutting square threads (right hand only) on a lathe-checking with thread gauge-grinding of tool and setting in correct position.	Turning of taper by taper turning attachment advantages and dis-advantages taper calculations. Screw cutting on a lathe. Terms relating screw thread major/ minor diameter pitch and lead of the screw, depth of thread simple gear train and compound gear train change gears for fractional pitches. Difference between single and multi-start threads-their uses merits and demerits. Broach - its types and uses. Square thread its form and calculation of depth, core dia, pitch dia. Acme thread its forms use and calculations.
2.	Exercise on use of pillar drill in drilling, counter sinking, counter boring. Spot facing and use of spot facing tools. Further practice of drilling of Radial drills. Practice of reaming on drilled holes.	Square threads-its forms and calculations of depth, core dia, pitch dia, Acme threads-its forms, use and calculations. Face plate- its construction safety precaution in holding jobs on face plate. Pillar drill machine constructional details, functions of parts. Application of pillar drill. Radial drills function parts etc. Reamer- parts, types, uses. Special tools – use and precautions to be observed for shaping internal keyways dovetails & ‘T’ slots. Various material for single point cutting tools, tipped tools, their brazing and grinding process. Tool angles and their effect on cutting various materials.

3.	Shaping cross dovetails mating jobs male and female. Grinding of form tools.	Cutting speed, feed, depth of cut for slotting, shaping and time calculation. Checking of dovetail grooves with vernier caliper and roller. Their calculations and use of sine bar, slip gauge and dial test indicator. Properties of metals general idea of physical, mechanical properties of metals, colour, weight, hardness toughness, malleability, ductility their effect on machine ability. Use of radius gauges and template. Introduction to jigs and fixtures. Types and uses.
4.	Machining of internal spline and external spline on slotter uses to match each other.	Interchangeability – Limit, Fit, Tolerances and allowances. Introduction and their indexing process on a slotter by its rotary table graduations. Form tool for slotting machines. Calculation for spur gear in relation to graduation of circular table.
5.	Cutting external and internal sprocket teeth on slotting machine, use of rotary table.	Calculation for cutting sprocket. Tool setting for dovetail use of relevant tool and their grinding process. Alignment of long jobs with precision instruments. Hydraulic transmission in machine tool- its advantages and application hydraulic system of a planer. Use of planer gauge for setting tool and template for profile checking.
6.	Boring a cast block on a vertical milling machine, measurement of bore size. Demonstration of marking system of Grinding wheels. Surface grinding practices.	Vertical milling machines its parts, construction, method of boring in a vertical milling. Difference between horizontal and vertical milling machine. Elements of milling cutter Rake angle, primary, secondary and clearance angles, lead etc. Selection procedure of grinding wheels. Abrasives its types Bonds, Grade Grit, structure, different shape of wheels and their uses. Inside micrometer, Principle, construction graduation reading both in English and metric system gauge types and uses.

7.	Demo of parts of CNC machining center – control switches, console buttons and machines specifications (spindle power, axes traverse, etc.) Demonstration of machine parts - bed, spindle motor and drive, tool changer, axes motors and ball screws, guide ways, LM guides, console, electrical, coolant system, hydraulic system, chip conveyor. Working of parts explained using multimedia CNC simulator. Parts shown on machine. CNC part programming with simple exercises and various programming codes. Practice on CNC machine simulator.	CNC technology basics: Difference between CNC and conventional lathes. Advantages and disadvantages of CNC machines over conventional machines. Schematic diagram of CNC system. Axes convention. Working of parts explained using multimedia CNC teachware. Parts shown on machine. Programming – G code & M code, sequence, formats, different codes, canned cycles. Absolute and incremental programming. Tool nose radius compensation (G41/42). Cutting tool materials, cutting tool geometry – insert types, holder types, insert cutting edge geometry. Cutting parameters - cutting speed, feed rate and depth of cut. Process planning, tool selection and cutting parameters selection. Explained using multimedia CNC teachware and CNC machine simulator.
8.	CNC machining center operation in various modes: jog, single block, auto, MDI, edit, etc. Program entry. Setting of tool offsets, entry of tool radius. Practice on CNC machine simulator. Program and cut parts on CNC machining center with face milling, contour milling with tool radius compensation, pocket milling, drilling, peck drilling, countersinking, tapping operations using canned cycles for hole operations. First 80 % of the practice is on CNC machine simulator, followed by 20 % on machine.	Program execution in different modes like single block, manual and auto. Tool and work offsets setting. Prepare various programs as per drawing. Concepts taught using multimedia CNC teachware. Surface finish. Surface roughness related BIS symbols
9.	Make operation sequence for different operations (milling , drilling ,shaping, slotting) Prepare different types of documentation as per industrial need by different methods of recording information.	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. TPM (Total Production Management), TQM (Total Quality Management). Spiral introduction, type and elements. Difference

		between helix & spiral. Difference between R.H. and L.H. helix.
10.	Milling gears by differential indexing, Measuring the teeth with a vernier gear tooth caliper.	Spiral-lead, helix angle and calculation. Cam Introduction development and use. Use of proper cutting speed and feed for various metals. Calculation for the machining time, machining allowances. Lubricant/coolants and various ways of their application. Cam-lobe, lead setting of dividing head, Calculation. Vernier gear tooth caliper, its construction and application in checking gear tooth.
11.	Milling spline (external) Milling straight fluted Reamer. Milling a helical groove in a vertical milling machine.	Introduction to broaching methods of milling splines. Its calculations and selection of cutters. Spiral milling lead, pitch, helix angle R.H. and L.H. swiveling the table in relation to the helix angle, selection of cutter for spiral milling. Calculations for spiral milling. Cam-types, application in modern m/c. tools, its special advantages, manufacturing process, calculation for milling a drum cam. Helical gear introduction elements and calculation. Introduction geometry and uses of bevel gears. Quality control types of variation, causes of variation, measurement of testing, gear & error.
12.	Milling a rack. Cutting worm and worm wheel on a milling machine, gashing and finishing.	Introduction to rack, its use & application. Rack cutting attachment, calculation for linear pitch, circular pitch, Gear ratio, Indexing movement, etc. Introduction, geometry and use of worm and worm wheel.
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**

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** 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, LEAN, CONCEPT etc.)
2. Prepare different types of documentation as per industrial need by different methods of recording information such as Route Card, Hydro test report, Job Card, MR Slip.
3. Perform marking out the components for filing, drilling, and allied operations such as milling & turning.
4. Plan and organize the work for different types of fitting operations and check for work result.
5. Blueprint reading of technical documents - part, assembly drawings.
6. Produce finished components by performing different shaping & slotting operation and check for accuracy without any assistance.
7. Produce finished components by performing different planing operation and check for accuracy without any assistance. (Optional)
8. Produce finished components by performing different lathe operations and check for accuracy without any assistance.
9. Produce finished components to perform different milling operations and check for accuracy without any assistance.
10. Perform preventive maintenance of lathe, shaping, slotting, planning, and milling machines.

B. BLOCK – II (09 months)

1. Process planning - machining sequence, cutting tools selection, cutting parameters, work holding devices.
2. Produce different forms of threads viz., "V", Square and Acme thread applying basic methods, machine tools, materials and information.
3. Work out and apply cutting parameters for different turning, drilling& milling operations with different work and tool material for producing quality output.
4. Grind Form tool and parallel & stepped using grinding machine with accuracy using appropriate tools & materials and with required quality.
5. Manufacture different components viz., V-block, Key-way, concave & convex surface, horizontal, angular, vertical, male-female T-slot & dovetail,

multiple jobs at a time by determining use of shaping /and slotting /and planning machine.

6. Produce different components by performing different operation viz., step milling, straddle milling, square & hexagonal milling, T-slot & dovetail milling using milling machine with clear choice of procedures.
7. Demonstrate practical skills to ream the drilled hole using radial drill machine.
8. Make different components viz., spur gear, helical, Bevel, worm & worm wheel, rack & pinion by setting the milling machine.
9. Produce different components viz., end mill/drum cam, face cam, plate cam using milling machine and by applying quality concept.
10. Manufacture different components viz., spline (external), straight fluted reamer, cylindrical cutter, slab milling cutter, twist drill using milling machine with clear choice of procedures.
11. CNC part programming, operations and machine settings virtually and practically.
12. Set and operate CNC Vertical Machining Centre (3 – axes) to produce components by preparing part programmes.
13. Preventive maintenance of CNC machines.
14. Set and operate surface & cylindrical grinder to produce components and check the job accuracy without anybody help.
15. 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

LIST OF TOOLS & EQUIPMENTS FOR 16 APPRENTICES

A : TRAINEES TOOL KIT:-

Sl. No.	Description	Qty.
1	Steel rule 30 cm graduated both in English & Metric units	16 nos.
2	Outside spring caliper 150 mm	8 nos.
3	Inside spring caliper 150 mm	8 nos.
4	Hermaphrodite caliper 150 mm	8 nos.
5	Divider spring 150 mm	8 nos.
6	Centre Punch 100 mm	8 nos.
7	Hammer B.P. 0.5 kg.	16 nos.
8	Cold chisel flat 25 x 200 mm	16 nos.
9	File flat bastard 300 mm	16 nos.
10	File flat 2nd cut 250 mmt	16 nos.
11	File flat smooth 200 mm	16 nos.
12	Engineers screw driver	16 nos.
13	Combination Plier 150 mm	16 nos.
14	Safety glasses	16 nos.

B: Tools, Instruments and General Shop Out fits

Sl. No.	Description	Quantity
15	Surface plate 400 mm x 400mm grade	1 no.
16	Table for surface plate 900 x 900 x 1200 mm	1 no.
17	Marking off table 1200 x 1200 x 900 mm high	1 no.
18	Scribing block universal 300 mm	2 nos.
19	V- Block 100/7 – 80 – A	2 nos.
20	Try square 300 mm	2 nos.
21	Outside spring caliper 200 mm	2 nos.
22	Divider spring 200 mm	2 nos.
23	Inside spring caliper 200 mm	2 no.
24	Straight edge steel 1 meter	1 no.
25	Straight edge steel 500 mm	1 no.
26	Steel tape 2 meter in case	1 no
27	Steel rule 60 cm graduated both in English & Metric units	2 nos.
28	Sprit level 2V 250, 05 meter	1no
29	Hammer B.P. 800 gms. With handle	4 nos.
30	Screw driver, heavy duty 300 mm with handle	4 nos.
31	Hammer lead 1 kg.	2 nos.
32	Spindle blade screw driver 100 mm	4 nos.
33	Allen Hexagonal keys 2.5 to 12	2 sets
34	Spanner D.E. series 2 (set of 7 pieces)	6 sets
35	Adjustable spanner 300 mm	2 nos.
36	Reduction sleeve Morse 1-1, 3-1, 4-1, 4-2, 5-1, 5-2, 6-1,	2 nos. each
37	Angle plate size 200 x 100 x 200 mm	2 nos.
38	Angle plate adjustable 250 x 150 x 175 mm	2 nos.

39	Solid parallels in pairs (different sizes) in Metric	12 pairs (assorted)
40	Oil Can pressure feed 500 mg.	6nos
41	Oil stone 150 x 50 x 25 mm	2nos
42	Number drills H.S.S. (parallel shank)	1set
43	Twist drills 3 mm to 13 mm in step of 0.5 mm (parallel shank)	2set
44	Drill Chuck 0.20 with taper shank	1no
45	Centre drill A 1 to 5	2set
46	Grinding wheel dresser (diamond)	1no
47	Grinding wheel dresser Huntington type	2 nos.
48	Clamps C 100 mm	2nos
49	Clamps C 200 mm	2nos
50	Tap and Die set in box metric pitch (6 mm to 12 mm)	1set
51	Drill H.S.S. taper shank (6 mm to 12 mm in step of 0.5 mm)	2set
52	File flat 2^{nd} cut 250 mm	4nos
53	File flat smooth 200 mm	4nos
54	File Half round 2^{nd} cut 250 mm	4nos
55	File triangular smooth 200 mm	4nos
56	Needle file set	1no.
57	File square 2^{nd} cut 250 mm	4nos
58	Reamer 6 mm to 25 mm by 1 mm	1set
59	Reamer adjustable 10 mm to 15 mm by 75 mm	1set
60	Tool bits H.S.S. 6 mm square	1 Dozen
61	Tool bits H.S.S. 10 mm square	1 Dozen
62	Tool bits holder (Armstrong) L.H	4nos
63	Tool bits holder (Armstrong) R.H.	4nos
64	Assorted tools and bit holders for lathe, shaper, slotter& planner in different shapes and sizes	As required
65	Hacksaw frame adjustable 250-300 mm with blades	2nos

66	Table chuck 75 mm jaw swivel base	1no
67	Machine vice 200 mm swivel base	4nos
68	Machine vice 160 mm swivel base	2nos
69	Hand vice 50 mm jaw	2nos
70	Radius turning attachment	1no
71	Angle turning attachment	1no
72	Compound angle vice (standard sine)	1no
73	Universal vice 150 mm	1no
74	Universal table angle plate	1no
75	Shaper tool holder turret type	2nos
76	Base chuck for slotter	1no
77	shaper indexing center	1no
78	Knurling tools (set of 3) straight and diamond	1each
79	Plier cutting 200 mm	2nos
80	Carbide tipped tools of different sizes and shapes (throw away tips)	2sets
81	Hand hammer 1 kg. With handle	2nos

C: Milling Cutters

Sl. No.	Name & Description of Cutters	Quantity
1	Cylindrical cutter 63 x 90 bore dia	3nos
2	Cylindrical cutter 80 x 90 bore dia.	3 nos.
3	Side and face cutter dia 80 x 8	2 nos.
4	Side and face cutter dia 160 x 10	3 nos.
5	Side and face cutter dia 100 x 12	2 nos.
6	Side and face cutter dia 160 x 16	2 nos.
7	Side and face cutter dia 200 x 20	3 nos.
8	Side and face cutter dia 100 x 10	2 nos.

9	Equal angle cutter 45^0/100	2 nos.
10	Equal angle cutter 60^0/100	2 nos.
11	Equal angle cutter 90^0/100	2 nos.
12	Double angle unequal cutter 50 x 12 x 55^0	2 nos.
13	Double angle unequal cutter 50 x 12 x 60^0	2 nos.
14	Double angle unequal cutter 50 x 12 x 70^0	2 nos.
15	Double angle unequal cutter 50 x 12 x 75^0	1 no
16	Single angle cutter 63 x 18 x 45^0 RH	1 no
17	Single angle cutter 63 x 18 x 45^0 LH	1 no
18	Single angle cutter 63 x 18 x 60^0 RH	1 no
19	Single angle cutter 63 x 18 x 60^0 LH	1 no
20	Slitting Saw cutter Ø 75 x 3 X Ø 27 mm	2 nos.
21	Slitting Saw cutter Ø 100 x 6 X Ø 27 mm	2 nos.
22	Shell End Mill Ø 50 x 36 x Ø 22 (preferably inserted tip type)	2 nos.
23	Shell End Mill Ø 75 mm x 50 x Ø 22 (preferably inserted tip type)	2 nos.
24	Parallel shank end mills Ø6, Ø10 and Ø 16 are (double fluted), Ø 20 mm & Ø 25mm (four fluted)	4 nos. each
25	'T' slot cutter with parallel shank- Ø 17.5 x 8 mm width x dia. of shank 8 mm	2 nos.
26	Concave Milling cutter Ø 63 x 6 radius x Ø 27 mm	1 nos.
27	Convex Milling cutter Ø 63 x 6 radius x Ø 27 mm	1 nos.
28	Disc type form milling cutter (involutes form -2 module, 20° pressure angle)	1 set

D: MEASURING INSTRUMENTS

Sl. No.	**Name & Description of Instruments**	**Quantity**
1	Micrometer outside 0-25 mm	4 nos
2	Micrometer outside 25-50 mm	2 no
3	Micrometer outside 50-75 mm	1 no

4	Micrometer depth gauge 0-200 mm	1no
5	Digital micrometer 0-25 mm	1 no
6	Direct reading vernier caliper 0- 300 (direct reading with dial)	1no
7	Digital vernier caliper 0- 300 mm	1 no
8	Vernier height gauge 250 mm	1 no
9	Vernier gear tooth caliper	1no
10	Combination set with 300 mm rule	2 sets
11	Vernier bevel protractor with 150 m blade	1 no
12	Bevel gauge 200 mm	1 no
13	Telescopic gauge 13 mm to 300 mm	1set
14	Sine Bar 200 mm	1 no
15	Dial test indicator with magnetic gauge type 1 grade A with magnetic base	1 no
16	Center gauge 60^0	1 no
17	Slip gauge set (normal set) metric (for the whole institute)	1 set
18	Screw pitch for metric pitches (25-6 mm)	2 sets
19	Radius gauge metric set (1-6 mm)	1 set
20	Limit plug gauges 5 mm to 25 mm by 2.5 mm	1 set
21	Ring gauges 5 mm to 25 m by 2.5 mm (GO & NO GO)	1 set
22	Taper gauge M.T. No. 1, 2, 3, 4 & 5	1 set
23	Feeler gauge	1 no
24	Planer gauge standard size	1 no
25	Magnifying glass 75 mm	2nos

E: FURNITURE

Sl. No.	**Name & Description**	**Quantity**
1	Steel lockers for 12 trainees	1no
2	Steel chair for Instructor	1 no

3	Steel table for Instructor	1 no
4	Work bench for Fitters with 2 vices of 100 mm jaw	1no
5	Steel cup board 180 x 90 x 45 mm	1 no
6	Steel cup board 120 x 60 x 45 cm	1no
7	Black board with easel	1 no
8	First Aid Box	1 no

F : General Machinery Shop outfit

Sl. No.	**Name & Description of Machine**	**Quantity**
1	Shaping machine 450 mm stroke (motorized) with all attachments	2 nos.
2	Shaping machine 315 mm stroke (hydraulic) with all attachments	1 no
3	Double column planer 1500 x 1000 x 1000 (motorized) with all attachments	1no
4	Slotter 180 mm stroke (motorized) with all attachments	1no
5	SS and SC centre lathe (all geared) with specification as: Centre height 150 mm and centre distance 1000 mm along with 4 jaw chuck, Taper turning attachment, steadies, auto feed system, safety guard, motorized coolant system, with lighting arrangement and set of lathe tools.	3 nos.
6	Tool and cutter grinder 250 mm to admit 450 m between center-fully motorized work head supplied with tool rest of different types table clamps and other attachments.	1 no
7	Drilling machine pillar 20 mm capacity with drill chuck & key.	1 no
8	Radial drill 1200 mm area motorized with tapping attachment	1no
9	Silicon carbide grinder for carbide tipped tools	1 no.
10	Double ended Pedestal Grinder with 178 mm wheels(one fine and one rough wheel)	1 no.
11	Universal Milling machine with minimum specification as: Table Length x width 1200 x 300 mm having motorized up & down movement along with auto feed arrangement and with following attachments such as: a. Vertical head b. Slotting attachment	2 nos.

	c. Rack cutting attachment d. Rotary table e. Dividing head f. Adaptors, arbors and collects etc. for holding straight shank drills and cutters from 3 mm to 25 mm.	
12	Horizontal Milling Machine with minimum specification as: Table Length x width 1200 x 300 mm having motorized up & down movement along with auto feed arrangement and 150mm Universal vice.	1no
13	Vertical Milling Machine with minimum specification as: Table Length x width 1200 x 300 mm having motorized up & down movement along with auto feed arrangement along with 150mm universal vice.	1 no
14	Surface Grinding Machine with minimum specification as: Grinding machine plain surface, wheel dia. 175 mm (or near) with reciprocating table having longitudinal table traverse 200 mm (or near) fully automatic and fitted with adjustable traverse stops, machine to be fully motorized and fitted with ace guards and pumps, tank and pump fittings and also to be supplied with magnetic chuck 250 x 112 mm. Diamond tool holder, set of spanners, grease gun, oil-can and spare grinding wheel for general purpose grinding.	1 no
15	Cylindrical grinder Max. grinding length 300 mm Height of centre 130 mm Max. distance between centers 340 mm	1 no
@16	CNC Vertical Machining Centre with minimum specification as: Table size:500x250mm Travel X-axis x Y-axis x Z-axis: 300 x 250 x 250mm Auto Tool Changer: 8 nos. Spindle power: 3.7kW (continuous rating) with popular control system like Fanuc/Siemens along with motorized coolant system.	1 No.
@17	a) Multimedia teachware/courseware for CNC technology and interactive CNC part programming software for turning & milling with virtual machine operation and simulation using popular operation control system such as Fanuc, Siemens, etc. (Web-based or licensed based) (10 trainess + 1 faculty) b) Desktop with MS-Windows-7 or latest to run above software, networked on LAN.	a) 11 users. b) 11 nos.

18	CNC milling tools assorted such as adapter to suit above machine to accommodate face cutter, shell end mill cutter, taper shank and parallel shank drills/cutters.	2 sets along with cutters & inserts.
19	CNC hole machining tools assorted such as adapter to suit above machine to accommodate different boring bars.	2 sets along with cutters
20	LCD projector / large screen TV	1 no.

NOTE:

1. No additional items are required to be provided to the batch working in the second and third shift except the items under trainee's lockers.
2. Items marked @ are not required to be provided for any additional batches.
3. Training should be imparted on forging heat treatment by utilizing the existing facilities where-ever available.
4. Institute having computer lab may use the existing infrastructure to impart simulation training & in that case not required to procure item no. 17 b

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: MACHINIST

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

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.