

**CURRICULUM**

**FOR THE TRADE OF**

**TOOL AND DIE MAKER**  
**(DIES AND MOULDS)**

**UNDER**

**APPRENTICESHIP TRAINING SCHEME**



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

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## 2. BACKGROUND

### 2. 1. Apprenticeship Training Scheme under Apprentice Act 1961

The Apprentices Act, 1961 was enacted with the objective of regulating the programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate(ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry. There are four categories of apprentices namely; **trade apprentice, graduate, technician and technician (vocational) apprentices.**

Qualifications and period of apprenticeship training of **trade apprentices** vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department of Education, Ministry of Human Resource Development.

### 2. 2. Changes in Industrial Scenario

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

### 2. 3. Reformation

The Apprentices Act, 1961 has been amended and brought into effect from 22<sup>nd</sup> 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 Tool and Die Maker – Dies & Moulds trade)**

1. The greater degree of relevance of the training with latest advancements of the industry will enhance the employability opportunities
2. It will enhance the ability to verify dimensions, alignments, and clearances of finished parts for conformance to specifications.
3. It will enhance the ability to study blueprints, sketches, models, or specifications to plan sequences of operations for fabricating tools, dies, or assemblies.
4. It will enhance the ability to inspect finished dies for smoothness, contour conformity, and defects.
5. It will enhance the ability to fit and assemble parts to make, repair, or modify dies, gauges, and tools, using machine tools and hand tools.
6. It will enhance the ability to start and operate furnace, oven, die-casting, core-making, metal molding, or rotating machines to pour metal or create molds and casts.
7. It will enhance the ability to adjust temperature controls of ovens or other heating equipment.
8. It will enhance the ability to inspect metal casts, and molds for cracks, bubbles, or other defects and measures castings to ensure specifications met.
9. It will enhance the ability to estimate weighs of metals and powders and computes amounts of materials necessary to produce mixture of specified content.
10. It will enhance the ability to repair or replace damaged molds, other equipment, using hand tools.
11. It will enhance the ability to develop and design new tools and dies or other devices for production equipment.
12. It will enhance the ability to operate machines or processes using either control mechanisms or direct physical activity.

## 4. JOB ROLES: REFERENCE NCO

### Brief description of Job roles:

**Die Maker; Die Fitter; Press Tool Fitter** makes metal dies to prescribed dimension for punching, cutting, forging and forming of metal or synthetic components for mass production. Studies drawing and specifications of dies to be made. Selects required type of metal or rough cast metal block. Machines or grinds one surface and marks it with template or otherwise to indicate dimensions and other working details. Cuts shapes, drill holes and mills metal according to marking on various machines. Checks dimensions while working with gauges and other measuring tools. Finishes made die (punch) by filing to required dimension and fits female to it. Files cutting angle and clearance accurately in female die and checks for sizes. Drills holes and cuts thread in female die for driving guide pin and fitting guide plates. Gets male and female dies tempered and grinds them to finish ensuring correct shear, cutting angle, clearances, etc. Sets finished dies in press and cuts or forms some trial pieces to ensure accuracy and correct production. May shape female die block to required angle for fitting it in bolster. May repair used dies and grind them to desired finish. May operate lathe, milling and shaping machines and harden and temper dies.

**Die Sinker, Hand** makes metal dies in two halves for manufacture of metal and synthetic components using fine chisels, hand tools, machine, etc. Studies samples or drawings of dies to be made. Selects right type of metal or alloy rough cast blocks. Gets one surface of each block ground finished. Marks one block to indicate position, size and shape of die to be cut. Follows marking and removes metal with different types of chisels, scrapers, etc. to form one half of die to be made. Measures amount of metal removed frequently while working with depth gauge, template, foot rule etc. to ensure correct forming. Transfers markings to other die block and (forms) and shapes it in similar manner to form other half of die. Takes lead casting of complete die formed and measures it (casting) with calipers, micrometre, etc. for dimensions. Makes alternations in die halves if required checks with further lead castings and ensures that product formed conforms to prescribed specifications. Gets die halves tempered and finishes them by grinding. Sets them in machine and stamps or forges some trial pieces to ensure correct formation. May anneal, grind and sink dies again if necessary. May do primary sinking of dies in vertical milling machine.

**Moulder, General** prepares mould from foundry sand using pattern for casting metal parts. Places pattern on mould plate (Wooden plate with arrangements to hold pattern). Makes mould in two halves (top and bottom) by ramming foundry sand around pattern. Removes pattern carefully and mends two halves of mould by trowel and smoothners. Makes vent holes by wire for escape of gas and other holes on top box for pouring metal into mould and for escape of excess molten metal (runners and risers). Fixes dried 'cores' in proper position to have designed holes in casting. May prepare bottom half of mould in floor instead of in bottom box. May dry moulds by fire in case of heavy castings. May do additions and alternations in mould from drawing, using foot rule, knife and trowel. May be known as PIPE MOULDER if engaged in pipe moulding.

**Core Maker, Moulding (Hand)** prepares cores with core sand (foundry sand mixed with some bonding agent such as molasses) for casting cavities in metal parts. Sprays ash, silica or other non-adhering powder on sides of core box, partially fills box with core sand, and inserts metal strengthening pins, wires (grid bars). Fills in and compacts more sand until core box is full. Makes vent holes in core with wire. Removes core from core box, mends it if necessary and places it in oven for drying. May apply plumbago mixed with molasses and water to obtain smooth finish on finished castings.

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:** 7222.50
- ii). **NCO-2004:** 7222.60
- iii). **NCO-2004:** 7211.10
- iv). **NCO-2004:** 7211.50

## 5. GENERAL INFORMATION

1. **Name of the Trade** : **TOOL AND DIE MAKER  
(DIES AND MOULDS)**
2. **N.C.O. Code No.** : **NCO-2004: 7222.50, 7222.60, 7211.10, 7211.50**
3. **Duration of Apprenticeship Training (Basic Training + Practical Training):** 2 years
- 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 10th 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 **TDM (Dies & Mould)/  
TDM (Press tool, Jigs & Fixture)/ 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: -

<b>Time (in months)</b>	<b>1-3</b>	<b>4-12</b>	<b>13-15</b>	<b>16-24</b>
<b>Basic Training</b>	<b>Block– I</b>	<b>-----</b>	<b>Block – II</b>	<b>-----</b>
<b>Practical Training (On - job training)</b>	<b>----</b>	<b>Block – I</b>	<b>-----</b>	<b>Block – II</b>

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
<b>Basic Training Block - I</b>	█	█	█																					
<b>Practical Training Block - I</b>				█	█	█	█	█	█	█	█													
<b>Basic Training Block - II</b>													█	█	█									
<b>Practical Training Block - II</b>																█	█	█	█	█	█	█	█	█

**7. SYLLABUS**  
**7.1 BASIC TRAINING**  
**(BLOCK – I & II)**  
**DURATION: 06 MONTHS**

**GENERAL INFORMATION**

- 1) **Name of the Trade** : **TOOL AND DIE MAKER**  
**(DIES AND MOULDS)**
- 2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)
- 3) **Batch size** : 20
- 4) **Power Norms** : 29.6 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 **Tool & Die Maker (Dies & Moulds)** 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.	<p><b>Engineering Drawing:</b> 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.</p>	<b>30</b>	<p><b>Units &amp; Measurements-</b> FPS, CGS, MKS/SI unit, unit of length, Mass and time. Fundamentals and derived units Conversion of units and applied problems.</p>	<b>20</b>
2.	<p>Lines : types and applications in Drawing as per BIS SP:46-2003 Drawing geometrical object using all types of lines. <b>Drawing of Geometrical Figures:</b> Angle, Triangle, Square, Rectangle and Circle. <b>Letters:</b> - Lettering styles, Single stroke letters and numbers as per IS standard. Lettering practice</p>		<p><b>Material Science :</b> properties - Physical &amp; Mechanical, Types - Ferrous &amp; Non-Ferrous, difference between Ferrous and Non-Ferrous metals</p>	
3.	<p><b>Dimensioning-</b> Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement, Alignment and indication of dimensions. <b>Scales:-</b>Types use and construction. Representative factor of scale.</p>		<p><b>Mass .Weight and Density :</b> Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density,</p>	
4.	<p>Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view</p>		<p><b>Speed and Velocity:</b> Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation. Average Velocity, Acceleration &amp; Retardation. Related problems.</p>	

			Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force	
5.	<b>Constructions:</b> - 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		<b>Ratio &amp; Proportion :</b> Simple calculation on related problems. <b>Percentage:</b> 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 <sup>st</sup> angle and 3 <sup>rd</sup> angle projection as per IS specification. Free hand Drawing of Orthographic projection from isometric/3D view of geometrical blocks		<b>Work, Power and Energy:</b> 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**

<b>Topic No.</b>	<b>a) Engineering Drawing</b>	<b>Duration (in hours)</b>	<b>b) Workshop Science &amp; Calculation</b>	<b>Duration (in hours)</b>
1.	<b>Screw :-</b> Its Types and Sizes, Screw thread, their standard forms as per BIS, external and internal thread.	<b>30</b>	<b>Algebra:</b> Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	<b>20</b>
2.	<b>Rivets and Joints:-</b> Prepare a drawing sheet on rivets nomenclature and Joints.		<b>Heat &amp; Temperature:</b> 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.		<b>Mensuration:</b> 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.		<b>Basic Electricity:</b> 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 earthing.	
5.	Simple exercises related to trade related symbols. Basic electrical and electronic symbols		<b>Simple machines</b> <b>Transmission of power:</b> - Transmission of power by belt, pulleys & gear drive. <b>Heat treatment process:</b> - Heat treatment and advantages.	

			Annealing, Normalizing, Hardening, Tempering.	
6.	Free hand sketch of trade related components / parts /cutting tool indicating angles.		<b>Trigonometry:</b> 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.			<b>Concept of pressure -</b> <b>Definition:-</b> Force, Pressure, and their units, atmospheric pressure, gauges used for measuring pressure, problems.  Introduction to pneumatics & hydraulics systems.	
8.	<b>Simple exercises related to trade related Test Papers. Solution of NCVT test papers.</b>			

## 7.1.2 DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

### A. Block –I

#### Basic Training

Week No.	Professional Skills	Professional Knowledge
1.	<p>Safety: - its importance, classification, personal, general, workshop and job safety. Occupational health and safety.</p> <p>Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution &amp; personal safety message.</p> <p>Preventive measures for electrical accidents &amp; steps to be taken in such accidents.</p> <p>Importance of housekeeping &amp; good shop floor practices. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc.</p> <p>Fire&amp; safety: Use of Fire extinguishers.</p>	<p>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.</p> <p>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.</p> <p>Introduction to 5S concept &amp; its application. Fire: - Types, causes and prevention methods. Fire Extinguisher, its types.</p> <p>Global warming its causes and remedies. Industrial Waste its types, sources and waste Management.</p>
2.	<p>Identification of tools &amp; equipments as per desired specifications for marking &amp; sawing( Hand tools , Fitting tools &amp; Measuring tools)</p> <p>Uses of marking tools, Punch, Try square &amp; 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.</p> <p>Filing, Chipping &amp; scraping flat surfaces and measure using different measuring instruments.</p>	<p>Introduction hacksaw cutting, marking, filling operation, need and application, types of files and their construction and usage Perpendicularity, parallelism.</p> <p>Hand tools and its importance, steel rule, Try square, chisel, surface gauge and care &amp; maintenance, Hacksaw frame, blades.</p> <p>Classification and types of chisels, files &amp; uses, vices - its constructions and uses. Hammers and its types. Related safety.</p> <p>Marking block, Steel rule, and calipers- different types and uses. Hacksaw blade, Hacksaw frame and its types. Drill bits- parts, Types &amp; uses.</p> <p>Different measuring instruments and gauges</p>



		used in shop floor, their construction and usage.
3.	<p>Mounting and dismantling of different drills on machines and different practical exercises.</p> <p>Marking and Drilling holes on flat pieces. Tapping as per simple drawing.</p> <p>Exercise on use of pillar drill in drilling, counter sinking, counter boring. Spot facing and use of spot facing tools.</p> <p>Further practice of drilling of Radial drills. Practice of reaming on drilled holes.</p>	<p>Identification of different parts, accessories, attachments, operations and tools used in drilling machines.</p> <p>Introduction to Hand Taps &amp; Dies and their types, applications, care and maintenance. Familiar with tap and drill size, Thread Terminology.</p>
4.	<p>Lathe: 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 &amp; drilling.</p> <p>Parallel turning between centers, parting off, chamfering using roughing, finishing and parting off tools.</p> <p>Holding the job in three jaw chuck truing, centering facing. Step turning undercutting, knurling drilling and boring.</p>	<p>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.</p> <p>Lathe tools their angles &amp; uses. Driving mechanism, speed and feed mechanism &amp; lathe accessories.</p>
5.	<p>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.</p> <p>Cutting V thread external and internal in a lathe. Checking up with screw pitch gauge. Cutting square thread external &amp; internal on a lathe.</p> <p>Cutting square threads (right hand only) on a lathe-checking with thread gauge-grinding of tool and setting in correct position.</p>	<p>Chucks-different types of job holding devices on lathe and advantages of each type. Mounting and dismounting of chucks.</p> <p>Taper introduction, types and uses. Calculations of tapers. Measurement of taper by sine bar and slip gauges.</p> <p>Different thread forms their related dimensions and calculations screw cutting in a lathe.</p>

6.	<p>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.</p> <p>Sequence of milling six faces of a solid block. Checking the accuracy with the help of try-square scribing block and vernier height gauge.</p> <p>Step milling using side and face cutter checking with micrometer.</p>	<p>Milling machine importance of milling machine, types and specification of milling machine, driving and feed mechanism of milling machine.</p> <p>Classification &amp; different types of milling cutters &amp; their use. Parts and nomenclature.</p> <p>Vernier height gauge construction, graduations vernier setting &amp; reading, vernier bevel protractor, construction graduation setting and reading. Care and maintenance of vernier height gauge and bevel protractor.</p>
7.	<p>Straddle and gang milling operations including up-milling and down milling.</p> <p>Milling concave and convex surfaces.</p> <p>Introduction to indexing head types, setting and aligning of indexing head with reference to job on milling machine.</p> <p>Milling square and hexagonal job by simple indexing method.</p>	<p>Different milling operations plain-face, angular, form, slot, gang and straddle milling etc. Up and down milling.</p> <p>Different types of milling attachments and their uses.</p> <p>Indexing-introduction &amp; types. Indexing head-constructural details, function of indexing plates and the sector arms. Calculation for various types of indexing.</p>
8.	<p>Milling dovetail and 'T'slots both male &amp; female matching each other.</p> <p>Milling of spur gear.</p> <p>Introduction to grinding machine surface grinder, cylindrical grinder. Driving and feed mechanism, job holding devices mounting of wheels.</p> <p>Different practical exercises with different accuracy levels.</p> <p>Wheel balancing &amp; truing. Grinding of parallel and stepped jobs. Dressing of grinding wheels.</p>	<p>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.</p> <p>Types of Abrasives and their uses, Glazing and loading of wheels. Explain the importance and necessity of quality.</p>
9-10	<p><b>Tool &amp; Cutter Grinder:</b> Grinding of single point cutting tool blank. Grinding of plain and face milling cutter.</p>	<p><b>Tool &amp; Cutter Grinder:</b> Description of tool and cutter grinding machine. Work (cutting tool) holding devices for tool &amp; cutter grinder machine. Setting process of cutting tools and grinding wheel on tool &amp; cutter grinding machine.</p>

11	<b>Wire Cut</b> Machining practice / observation on Wire cut Machine.	<b>Wire Cut</b> Electrical discharge machining (EDM) - Introduction, principle of operation, advantages & disadvantages and its applications. Wire cut machine - introduction, principle of operation, advantages & disadvantages and its applications.
12	Introduction to gas welding equipment/arc welding equipment, Simple welding practice. Practice on brazing.	Explanation of gas welding and arc welding techniques. Description of welding equipment, types of welding joints. Knowledge about flux, filler rod material. Die welding techniques.
13.	<b>Revision &amp; Internal Assessment</b>	

**B. Block –II**  
**Basic Training**

Week No.	Professional Skills	Professional Knowledge
1-2.	<p><b>Hand Injection Mould:</b>            Identify different elements of hand injection mould. Manufacture simple parts as per drawing with different machining operations.</p>	<p><b>Hand Injection Mould:</b>            Constructional details of a basic injection mould (Hand injection mould) and application of hand injection mould. Importance of mould polishing, advantages of chrome plating, method of mould polishing.</p> <p>Introduction to tooling: Brief description of press tools, moulds for plastics, die-casting, jigs and fixtures.            Constructional features of a simple injection mould.</p>
3-7	<p><b>Manufacturing Moulds:</b>            Practice in Manufacturing different moulds viz., two cavity injection mould, single compression mould and plunger type transfer mould.</p>	<p>Introduction and constructional features of injection moulding machine. Specification of injection moulding machine and application.</p> <p>Different types moulds, their features and manufacturing methods.</p> <p>Types of parting surface. Different methods used in moulding internal undercuts.            Elements of mould cycle. Importance of mould cycle diagram.            Construction/design details of injection mould (plate ejection)</p> <p>Identification of common moulding defects that occur during injection moulding, reasons for defect in the component.            Compression moulding process. Procedure of compression moulding. Identification of common defect that occur during compression moulding            Transfer moulding process, advantages of transfer moulding.            Identification of common moulding defects. Reasons for the defects in the component.            Compression and transfer mould calculations.</p>

8-9.	Practice in manufacturing of pressure die casting die.	Die casting, hot chamber process and cold chamber process. Basic designs of a die casting die. Effect of metal on die casting process. Effect of die casting machine on process. Effect of die in process.
10.	<b>Hydraulics &amp; Pneumatics</b> Identification and familiarization of various types of hydraulic & pneumatic elements such as cylinder, valves, actuators and filters. Study of simple hydraulic & pneumatic circuits.	<b>Hydraulics &amp; Pneumatics</b> Basic principles of hydraulic & pneumatic system. Advantages & disadvantages of hydraulic and pneumatic system. Theory of Pascal's law, Brahma's press, pressure & flow. Type of valves used in hydraulic and pneumatic system.
11-12.	Program generation & Simulation with CAD/CAM software for dies & moulds.  Inspection of dies with measuring instruments.	Concepts of CAD/CAM Basic concepts of inspection of 3D surfaces. Part program generation and setting up the machine for producing punch/dies.  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.  Concept of TPM & TQM.
13.	<b>Revision &amp; Internal Assessment</b>	

### **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 12<sup>th</sup> /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)
	<b>English Literacy</b>	<b>15</b>
<b>1</b>	<b>Pronunciation :</b> Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
<b>2</b>	<b>Functional Grammar</b> Transformation of sentences, Voice change, Change of tense, Spellings.	
<b>3</b>	<b>Reading</b> Reading and understanding simple sentences about self, work and environment	
<b>4</b>	<b>Writing</b> Construction of simple sentences Writing simple English	
<b>5</b>	<b>Speaking / Spoken English</b> 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.	
	<b>I.T. Literacy</b>	<b>15</b>
<b>1</b>	<b>Basics of Computer</b> Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
<b>2</b>	<b>Computer Operating System</b> 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.	
<b>3</b>	<b>Word processing and Worksheet</b> 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	
<b>4.</b>	<b>Computer Networking and INTERNET</b> 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	

	<p>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.</p> <p>Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.</p>	
	<b>Communication Skill</b>	<b>25</b>
<b>1</b>	<p><b>Introduction to Communication Skills</b>  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</p>	
<b>2</b>	<p><b>Listening Skills</b>  Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.  Triple- A Listening - Attitude, Attention &amp; Adjustment.  Active Listening Skills.</p>	
<b>3</b>	<p><b>Motivational Training</b>  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</p>	
<b>4</b>	<p><b>Facing Interviews</b>  Manners, Etiquettes, Dress code for an interview  Do's &amp; Don'ts for an interview</p>	
<b>5</b>	<p><b>Behavioral Skills</b>  <b>Organizational Behavior</b>  Problem Solving  Confidence Building  Attitude  Decision making  Case study/Exercise</p>	



**B. Block– II  
Basic Training**

<b>Topic No.</b>	<b>Topic</b>	<b>Duration (in hours)</b>
	<b>Entrepreneurship skill</b>	<b>15</b>
1	<b>Concept of Entrepreneurship</b> <b>Entrepreneurship-</b> 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	<b>Project Preparation &amp; Marketing analysis</b> 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	<b>Institutions Support</b> 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	<b>Investment Procurement</b> Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.	
	<b>Productivity</b>	<b>10</b>
1	<b>Productivity</b> Definition, Necessity, Meaning of GDP.	
2	<b>Affecting Factors</b> Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.	
3	<b>Comparison with developed countries</b> 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	<b>Personal Finance Management</b> Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	<b>Occupational Safety, Health &amp; Environment Education</b>	<b>15</b>
1	<b>Safety &amp; Health</b> Introduction to Occupational Safety and Health importance of safety and health at workplace.	

2	<b>Occupational Hazards</b> Basic Hazards, Chemical Hazards, Vibro-acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.	
3	<b>Accident &amp; safety</b> Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.	
4	<b>First Aid</b> Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
5	<b>Basic Provisions</b> Idea of basic provision of safety, health, welfare under legislation of India.	
6	<b>Ecosystem</b> Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.	
7	<b>Pollution</b> Pollution and pollutants including liquid, gaseous, solid and hazardous waste.	
8	<b>Energy Conservation</b> Conservation of Energy, re-use and recycle.	
9	<b>Global warming</b> Global warming, climate change and Ozone layer depletion.	
10	<b>Ground Water</b> Hydrological cycle, ground and surface water, Conservation and Harvesting of water	
11	<b>Environment</b> Right attitude towards environment, Maintenance of in-house environment	
	<b>Labour Welfare Legislation</b>	<b>5</b>
1	<b>Welfare Acts</b> 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.	
	<b>Quality Tools</b>	<b>10</b>
1	<b>Quality Consciousness :</b> Meaning of quality, Quality Characteristic	
2	<b>Quality Circles :</b> 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	<b>Quality Management System :</b> Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.	
4	<b>House Keeping :</b> Purpose of Housekeeping, Practice of good Housekeeping.	
5	<b>Quality Tools</b> 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** : **TOOL AND DIE MAKER  
(DIES AND MOULDS)**
- 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 2<sup>nd</sup> 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 Tool **and Die Maker (Dies and Moulds)** 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.) emphasizing more on housekeeping.
2. Prepare different types of documentation as per industrial need by different methods of recording information.
3. Produce different components involving all the types of operations on conventional/CNC machines viz., lathe, milling, drilling & grinding.
4. Process about Die welding.
5. Grind/ re-sharpen cutting tools in Tool and Cutter Grinding machine.
6. **Wire Cut-** Machining practice / observation on machine.
7. Technique of forming cavities by different methods.
8. Material selection for the manufacture of core and cavity, pillars and other elements of dies and moulds. Factors to be considered for the selection of material like Load, Heat Resistance, Machinability etc. Selection of material on the basis of manufacture aspects and processing aspects. Application of non-ferrous materials for the manufacture of moulds and dies. Heat treatment its effect on functioning of different parts – different methods of heat treatment etc.
9. Quality check and Inspection of Moulds and Dies – Stage Inspection of Core, Cavity and mould elements. Inspection of additional tooling like Electrodes, Templates, Masters etc. Final inspection of the system incorporated in the moulds in respect of alignment, Matching, Feed System, Ejection System, Cooling System etc. and product inspection.

### B. Block-II (09 months)

1. Reading and understanding of Technical documents
2. Plastic Materials – Properties and its applications
3. Mould Polishing Technique – Purpose, Different methods and care while polishing, Tools and Equipment used for polishing etc.
4. Manufacture of *pressure die casting* die and/or *Hand Injection Mould* and/or two cavity injection mould and/or single *compression mould*, perform stage inspection and also process planning for the manufacture of dies and moulds.
5. Manufacture of plunger type transfer mould.
6. Identify potential causes for non-conformities to quality assurance standards for different dies and moulds – Trouble shooting – Rectification of tools – Maintenance of tools – Simple hydraulic/ pneumatic circuits and function of different elements of hydraulic and pneumatic system.
7. Programming for Simulation with CAD/CAM software for developing different elements of dies & moulds.
8. Cutting tools, work holding devices selection for CNC machine operations and CNC machine operations and machine settings virtually and practically.

9. Prepare part programme using G codes and M codes and manufacture different components on CNC machines.
10. Preventive maintenance of CNC machines.
11. Assignment should be planned so that the apprentices may spend more of the total time of production type of work (using gauges, templates, fixture etc.) for developing their skill and confidence about manufacturing which will help ever in self- employment, if found necessary in the future.
12. Operate EDM wire cut machine and produce components.
13. Case Studies – Designing of tools for different plastic dies and moulds – Trouble shooting – Rectification of Tool – Maintenance of tools – Simple hydraulic/pneumatic circuits.
14. Technique of forming cavities by electro forming, chemical etching, hobbing process etc.
15. In addition to the above mentioned skills/ operations industry may impart training on any other skills/ operations related to the trade.
16. 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 above 75%- 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)**

<b>SUBJECTS</b>	<b>Marks</b>	<b>Sessional Marks</b>	<b>Full Marks</b>	<b>Pass Marks</b>	<b>Duration of Exam.</b>
Practical	300	100	400	240	<b>08 hrs.</b>
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.
<b>Grand Total</b>	<b>550</b>	<b>150</b>	<b>700</b>	<b>-</b>	

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 involved in manufacturing dies & moulds.
2. Infrastructure and defence organisations
3. In public sector industries (Central and State) and private industries in India & abroad involved in manufacturing dies & moulds.

**TOOLS & EQUIPMENT FOR BASIC TRAINING****INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE****TRADE: TOOL AND DIE MAKER (DIES & MOULDS)****LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES****A : Trainee's Tool Kit :**

<b>Sl. No.</b>	<b>Description of Tools</b>	<b>For Instructor</b>	<b>For a batch of 20</b>
1	Steel Rule 150 mm English and Metric combined	1	20 nos.
2	Engineer's Square 150 mm with knife edge	1	20 nos.
3	Hacksaw frame adjustable with pistol grip for 200-300 mm blade	1	20 nos.
4	Centre punch 100 mm	1	20 nos.
5	Prick punch 150 mm	1	20 nos.
6	File flat bastard 300 mm	1	20 nos.
7	File flat 2 <sup>nd</sup> cut 250 mm	1	20 nos.
8	File flat safe edge 200 mm	1	20 nos.
9	File triangular smooth 200 mm	1	20 nos.

**B: Tools and Equipments:**

<b>Sl. No.</b>	<b>Name of Tools and Equipments</b>	<b>Quantity</b>
1	Caliper inside spring type-150 mm	4 nos.
2	Caliper outside spring type-150 mm	4 nos.
3	Divider spring type – 150 mm	4 nos.
4	Odd leg caliper firm joint 0- 150 mm	2 nos.
5	Screw driver – 150 mm	1 no.
6	Screw driver – 200 mm	1 no.
8	Centre gauge 55 <sup>0</sup> and 60 <sup>0</sup>	2 nos.
9	Oil can 250 ml	1 no.
10	File flat smooth 200 mm	4 nos.
11	File flat smooth with safe edge 200 mm	4 nos.

12	File half round bastard 300 mm	4 nos.
13	File half round smooth 250 mm	4 nos.
14	File triangular bastard 250 mm	4 nos.
15	File triangular smooth 200 mm	4 nos.
16	File round bastard 250 mm	4 nos.
17	File square bastard 300 mm	4 nos.
18	File square smooth 250 mm	4 nos.
19	Knife edge file 150 mm	4 nos.
20	Needle file assorted (12 nos.) 150 mm	4 sets
21	File card	4 nos.
22	Scraper flat 250 mm	4 nos.
23	Hammer Ball Peen 0.5 kg with handle	4 nos.
24	Hammer Cross Peen 0.75 kg with handle	4 nos.
25	Chisel cold flat 18 x 150 mm	4 nos.
26	Chisel Cross Cut 10 x 3 x 200 mm	4 nos.
27	Chisel Half Round 10 x 250 mm	4 nos.
28	Chisel diamond point 10 x 200 mm	4 nos.
29	Scribing block universal 300 mm	2 nos.
30	C.I. Surface plate 300 x 300 mm	1 no.
31	Granite Surface plate 600 x 600x80 mm	1 no
32	Tap extractor 3 mm to 12 mm x 1.5 mm (ezzy out)	1 set
33	Screw extractor sizes 1 to 8	1 set
34	Taps and dies metric 5 mm to 12 mm complete set in a box	2 sets
35	Twist Drill with St. Shank $\varnothing$ 5 to $\varnothing$ 12 mm in steps of 0.5 mm	1 set
36	Twist Drill St. Shank $\varnothing$ 8 mm to $\varnothing$ 12 mm in steps of 2 mm	1 set
37	Taper shank drills $\varnothing$ 6 mm to $\varnothing$ 20 mm in steps of 1 mm	1 set
38	D.E spanners 3-4 , 6-8, 10-12, 13-14, 15-16, 18-19, 20-22, 24-26 ( 8 spanners)	2 sets
39	Letter punch 5 mm set	1 set
40	Number punch 5 mm set	1 set
41	Drill chuck 12 mm capacity with key	1 no.
42	Allen key metric 3 to 12 mm set	2 sets
43	Centre drills 3, 4,5 mm	2 each
44	Parallel hand reamer 6 mm to 12 mm in steps of 1 mm	1 set
45	Star dresser	2 nos.
46	Diamond dresser with holder	2 nos.
47	Safety goggles (Personal Protective Equipments)	4 nos.
48	Demagnetizer	1 no.
49	Snips 200 mm blade	1 no.
50	Workbench 240 cm x 120 cm x 75 cm with 150 mm vice (Each bench fitted with 4 vices)	4 nos.
51	Bench Vice 150 mm	16 nos.
52	Steel lockers for 16 trainees (Pigeon Cup Board)	2 nos.
53	Steel cupboard 180 cm x 60 cm x 45 cm	6 nos.
54	Metal rack 180 cm x 60 cm x 45 cm	1 nos.
55	Fire extinguisher	2 nos.
56	Fire buckets with stand	4 nos.

57	Feeler gauge 0.05 mm to 0.3 mm by 0.05 and 0.4 mm to 1 mm by 0.1 mm (13 leaves)	1 set
58	Metric Screw pitch gauge-Range 0.4 -6 mm pitch 60 <sup>0</sup> (21 leaves)	1 set
59	Radius gauge 1 - 3 mm by 0.25 mm and 3.5-7mm by 0.5 mm (34 leaves)	1 no.
60	Vernier height gauge - Range 300 mm, with 0.02 mm least count	1 no.
61	Universal vernier caliper-Range 200 mm, with 0.02 mm least count	2 nos.
62	Dial vernier caliper 0-200 mm, with 0.02 mm least count	1 no.
63	Vernier caliper-Range 300 mm Vernier scale 0.02 mm	2 nos.
64	Vernier bevel protractor-Blade range 150 and 300 mm, dial 1 <sup>0</sup> , least count 5' (min.) with head, Acute Angle attachment	1 no.
65	Outside micrometer 0-25 mm, with 0.01 mm least count	2 nos.
66	Outside micrometer 25-50 mm, with 0.01 mm least count	1 no.
67	Outside micrometer 50-75mm, with 0.01 mm least count	1 no.
68	Combination square sets-300 mm blade with square head, centre head, protractor head	1 set
69	Telescopic gauge range 8 -150 mm (6 pcs/set)	1 set
70	Sine bar 150 mm with stopper plate	1 no.
71	Sine table 200 mm length with magnetic bed	1 no.
72	Slip Gauge Box (workshop grade) -87 pieces per set	1 set
73	Gauge block accessories consisting holders, half round jaws, scriber point, centre point , triangular straight edge (14 pcs/set)	1 set
74	Central square – Size 400 x 250 mm blade	1 no.
75	V-Block-Approx. 32 x 32 x 41 mm with clamping capacity of 25 mm with clamps	2 pairs
76	V-Block-Approx 65x65x80 mm with clamping capacity of 50 mm with clamps	1 pairs
77	Magnetic V-Block 100x100x125 mm	2 pairs
78	Angle plate 150 x 150 x 200 mm	1 no.
79	Angle plate-adjustable 250x250x300 mm	1no.
80	Inside micrometer – Range 50-63 mm with std extension rods upto 200mm..	1 set
81	Depth micrometer – Range 0-25 mm, accuracy 0.01 mm with std set of extension rods.	1set.
82	Magnetic stand with magnetic base 60 x 47.5 mm and with universal swivel clamp, dial holding rod (150 mm) scriber	2 nos.
83	Dial test indicator-Lever type- Range 0-0.8 mm –Graduation 0.01mm, reading 0-50-0 with accessories	1 nos.
84	Dial test indicator – Plunger type-Range 0-10 mm , Graduation 0.01 mm, Reading 0-100 with revolution counter	1 nos.
85	Bore gauge with dial indicator (1 mm range, 0-0.01 mm graduation)- Range of bore gauge 18-150 mm	1 set
86	Straight edge-Single beveled-Size 150 mm and 250 mm	1 each
87	Tool makers clamp 50 mm & 75 mm	2 nos. each
88	C – clamp- 50 mm & 75 mm	2 nos. each

### C : Cutting Tools :

Sl. No.	Name of Tools and Equipments	Quantity
1	Side and face milling cutter Ø 100 x 10 X Ø 25 mm	2 nos.
2	Side and face cutter Ø 80 x 10 X Ø 27 mm	2 nos.
3	Cylindrical milling cutter Ø 63 x 70 x Ø 27 mm	2 nos.
4	Slitting Saw cutter Ø 75 x 3 X Ø 27 mm	2 nos.
5	Slitting Saw cutter Ø 100 x 6 X Ø 27 mm	2 nos.
6	Single angle cutter Ø 75 x 16 x Ø 27mm - 60 <sup>0</sup>	2 nos.
7	Single angle cutter Ø 75 x 20 x Ø 27 - 45 <sup>0</sup>	2 nos
8	Equal angle cutter Ø75x 30 x Ø 27 - 90 <sup>0</sup>	2 nos
9	Shell End Mill Ø 50 x 36 x Ø 22 (preferably inserted tip type)	2 nos.
10	Shell End Mill Ø 75 mm x 50 x Ø 22 (preferably inserted tip type)	2 nos.
11	Parallel shank end mills Ø6, Ø10 and Ø 16 are (double fluted), Ø 20 mm & Ø 25mm (four fluted)	4 nos. each
12	'T' slot cutter with parallel shank- Ø 17.5 x 8 mm width x dia. of shank 8 mm	2 nos.
13	Concave Milling cutter Ø 63 x 6 radius x Ø 27 mm	1 nos.
14	Convex Milling cutter Ø 63 x 6 radius x Ø 27 mm	1 nos.
15	Disc type form milling cutter (involute form -2 module, 20° pressure angle)	1 set
16	Tool holder (straight) to suit 6, 8 mm sq. bit size	2 nos. each
17	Parting tool holders to suit 3 and 4 mm thick tool blade.	2 nos.
18	Boring bars with holders to accommodate 4, 6 and 8 mm HSS tool bits	3 each
19	Knurling tool (straight & diamond)	2 nos. each

#### D : General Machinery & Installation:

(Note: The specification given under “General Machinery & Installation” can be considered to the nearest size according to the availability in the Indian Market.)

Sl. No.	Name of Machineries and Equipment	Qty.
1.	Sensitive drilling machine - capacity 12 mm Motorized –with drill chuck and key etc.	1No.
2.	Pillar/column type Drilling machine – 25 mm capacity-motorized with drill chuck, key etc.	1No.
3.	Radial Drill machine to drill up to 32 mm diameter.	1No.
4.	Power hacksaw machine to accommodate 21” or more length blade.	1no.
5.	Double ended Pedestal Grinder with 178 mm wheels(one fine and one rough wheel)	1 no.
6.	SS and SC centre lathe (all geared) with centre height 150 mm and centre distance 1000 mm along with 3 jaws, 4 jaw chuck, auto feed system, taper turning attachment, coolant pump, safety guard and machine light arrangement.	3 nos.
7.	Shearing machine (lever type)hand operated complete with 300 mm blade length	1 no.
8.	Arc and gas welding and cutting equipment ( <b>Not required if Welding Trade is available in the Institute</b> )	1No.
	(i) Transformer welding set 300 amps-continuous welding current with all	1 set

	accessories and electrode holder (ii) Welding cable to carry 400 amps 50 meter with flexible rubber cover. (iii) Lugs for cable (iv) Earth clamps (v) Arc welding table (all metal top) 122cm x 12 cm x 60 cm with positioner (vi) Oxy-acetylene gas welding set-equipment with hoses, regulator and other accessories (vii) Gas welding table with positioner (viii) Welding torch tips of different sizes (ix) Gas lighter (x) Trolley for gas cylinders (xi) Chipping hammer (xii) Gloves (Leather) (xiii) Leather apron (xiv) Welding torches 5 to 10 nozzles (xv) Spindle key for cylinder valve (xvi) Welding goggles (xvii) Welding helmets with coloured glass (xviii) Tip cleaner	12 nos. 2 nos. 1 set 1 no. 1 set 6 nos. 1 no 2 nos. 2 pairs 2 nos. 1 set 2 nos. 4 pair 2 nos. 10 sets 2 nos. 1 no.												
9.	Universal Milling Machine -  <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Longitudinal traverse</td> <td style="width: 50%;">700 - 800 mm</td> </tr> <tr> <td>Cross traverse</td> <td>300 - 400 mm</td> </tr> <tr> <td>Vertical traverse</td> <td>200 - 350 mm</td> </tr> <tr> <td>Swivel of table on either side</td> <td>45<sup>o</sup></td> </tr> <tr> <td>Speed range rpm</td> <td>30 to 1800</td> </tr> </table> <p>With universal dividing head, circular table, long arbors, slab arbor, slotting attachment, vertical indexing head, etc.</p>	Longitudinal traverse	700 - 800 mm	Cross traverse	300 - 400 mm	Vertical traverse	200 - 350 mm	Swivel of table on either side	45 <sup>o</sup>	Speed range rpm	30 to 1800	1 no		
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10.	Horizontal and Vertical milling machine  <table style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2"><b>Table</b></td> </tr> <tr> <td style="width: 50%;">Length x width</td> <td style="width: 50%;">1350x310 mm</td> </tr> <tr> <td>Longitudinal traverse</td> <td>700 - 800 mm</td> </tr> <tr> <td>Cross traverse</td> <td>200 - 265 mm</td> </tr> <tr> <td>Vertical traverse</td> <td>300 - 400 mm</td> </tr> <tr> <td>Speed range rpm</td> <td>20 to 1800</td> </tr> </table>	<b>Table</b>		Length x width	1350x310 mm	Longitudinal traverse	700 - 800 mm	Cross traverse	200 - 265 mm	Vertical traverse	300 - 400 mm	Speed range rpm	20 to 1800	2 Nos. each
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11.	Hydraulic Surface Grinding Machine  <table style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2"><b>Table</b></td> </tr> <tr> <td style="width: 50%;">Clamping area</td> <td style="width: 50%;">600 x 178 mm</td> </tr> <tr> <td>Grinding area</td> <td>400 x 200 mm</td> </tr> <tr> <td>Distance table-centre of spindle</td> <td>400 - 500 mm</td> </tr> <tr> <td>Table speed</td> <td>1-25 m/min.</td> </tr> </table> <p>With standard accessories like dust extractor with water separator, balancing device, table-mounted Radius-tangent wheel dresser, wheel flanges, etc.</p>	<b>Table</b>		Clamping area	600 x 178 mm	Grinding area	400 x 200 mm	Distance table-centre of spindle	400 - 500 mm	Table speed	1-25 m/min.	2 Nos.		
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Distance table-centre of spindle	400 - 500 mm													
Table speed	1-25 m/min.													
12.	Tool and Cutter Grinder	1No.												

	Largest diameter of cutter that can be ground Max. admit between centers Max. length of cutting edges ground  With standard equipment like adaptor bushes, cutter head holder assembly, adaptors, extension spindle, flanges fro grinding wheel, etc.	10-100 mm 230 mm 120 mm	
13.	Universal cylindrical Grinding Machine		1No.
	Max. dia ground (effective) Max. grinding length Height of centre Max. distance between centers With special accessories like face plate, steady, radius and face dressers, find hand feed attachment etc.	250 mm 300 mm 130 mm 340 mm	
14.	Pantograph / Engraving 3D machine		1No.
	Working area (rectangle) Max. height of work <b>Work table traverse:</b> Longitudinal x Transverse Work clamping area With attachment like index head, roll engraving attachment, type template holders, circular table, raised and sunk letters etc.	320 x 145 mm 380 mm 160 x300 mm 360x200 mm	
15.	Muffle Furnace – Heating Chamber 300 x 300 x 450 mm for 1050 <sup>0</sup> C Quenching tank-600 x600 x 600 mm		1No.
16.	Rockwell Hardness Testing Machine with standard accessories		1No.
17.	Spark erosion EDM with standard accessories		1 No.
18.	Polishing kit		1 No.
19.	Hand Injection Moulding Machine 103 hand injection		1 No.
20.	Hand Compression Moulds: Compression moulding process (Mechanical for 50 gms) Minimum 25 Ton capacity.		1 No.
21.	Screw Type Injection Moulding Machine (capacity 50 gms) (Not required if plastic processing operator trade is available in the institute)		1 No.
22.	Blow Moulding Machine (Not required if plastic processing operator trade is available in the institute)		1 No.
23.	CAD/CAM software (Program generation and simulation software for moulds and dies)		4 nos.
24.	Desktop computers with latest configuration suitable for CAD/CAM software with necessary furniture		5 sets
25.	Vertical machining centre (VMC) (Optional)		01
26.	Co-ordinate measuring machine (Optional)		01
27.	Profile projector (Optional)		01

Note: Any institute not having the optional machines may tie up with an industry having the above machine for exposure.

**INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND  
ENGINEERING DRAWING**

**TRADE: TOOL AND DIE MAKER (DIES & MOULDS)**

**LIST OF TOOLS& EQUIPMENTS FOR 20 APPRENTICES**

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

2) **Infrastructure:**

**A : TRAINEES TOOL KIT:-**

<b>Sl. No.</b>	<b>Name of the items</b>	<b>Quantity (indicative)</b>
1.	Draughtsman drawing instrument box	20 Nos.
2.	Set square celluloid 45 <sup>0</sup> (250 X 1.5 mm)	20 Nos.
3.	Set square celluloid 30 <sup>0</sup> -60 <sup>0</sup> (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**

<b>Sl. No.</b>	<b>Name of the items</b>	<b>Quantity (indicative)</b>
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



**INFRASTRUCTURE FOR ON-JOB TRAINING**

**TRADE: TOOL AND DIE MAKER (DIES & MOULDS)**

**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.

**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.