

**SYLLABUS OF SEMESTER SYSTEM**  
**FOR THE TRADE OF**  
**OPERATOR ADVANCE MACHINE TOOL**  
**SEMESTER PATTERN**

**Under**

**Craftsmen Training Scheme (CTS)**  
**(Two years/Four Semesters)**

**Revised in**  
**2014**

**By**  
**Government of India**  
**Ministry of Labour & Employment (DGE&T)**

## GENERAL INFORMATION

1. **Name of the Trade** : OPERATOR ADVANCE MACHINE TOOL.
2. **N.C.O. Code No.** :
3. **Duration of Craftsmen Training** : Two years (Four semesters each of six months duration).
4. **Power norms** : 25 KW
5. **Space norms** : 144 Sq. meter.
6. **Entry Qualification** : Passed 10<sup>th</sup> Class with Science and Mathematics under 10+2 system of Education or its equivalent
7. **Trainees per unit** : 12 (Supernumeraries/Ex-Trainee allowed: 4)
- 8a. **Qualification for instructors** : Degree in Mechanical/Production Engineering from recognised University with one year post qualification experience in the relevant field.

OR

Diploma in Mechanical/Production Engineering from a recognised Board of Technical Education with two years post qualification experience in the relevant field.

OR

NTC/NAC in the Trade of Operator Advance Machine Tool trade with 3 years post qualification experience in the relevant field.

- 8b. **Desirable qualification** : Preference will be given to a candidate with Craft Instructor Certificate (CIC) in Operator Advance Machine Tool/Machinist trade.

**Note:**

- (i) Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.
- (ii) Instructor qualification for WCS and E.D, as per the training manual.

**Distribution of training on Hourly basis:**

Total hours /week	Trade practical	Trade theory	Work shop Cal. &Sc.	Engg. Drawing	Employability skills	Extra curricular activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

# **COURSE INFORMATION**

## **1. Introduction:**

- This course is meant for the candidates who aspire to become a professional operator of advance machine tools.

## **2. Terminal Competency/Deliverables:**

After successful completion of this course the trainee shall be able to perform the following skills with proper sequence.

- The trainees can work in the industry as semi-skilled operator.
- The trainee can work in the lathe, drilling, milling, Inspection & measurement, CNC lathe & milling observing safety precautions.
- Perform simple maintenance on machinery.

## **3. Employment opportunities:**

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

1. Production & Manufacturing (Public Sectors like BHEL, BEML, NTPC,ONGC & Private Sector ) .
2. Aero Space like HAL
3. Automobile and allied industries
4. Railways.
5. Ship building
6. Defence
7. Self employment

## **4. Further learning pathways:**

- On successful completion of the course trainees can pursue Apprenticeship training in the reputed Industries / Organizations.
- On successful completion of the course trainees can opt for Diploma course (Lateral entry).
- On successful completion of the course trainees can opt for CITS course.

# SYLLABUS FOR THE TRADE OF OPERATOR ADVANCE MACHINE TOOL

## First Semester

**(Semester Code no. OAM - 01)**

**Duration : Six Month**

Week No.	Trade Practical	Trade Theory
<b>1</b>	<p>Importance of trade training, List of tools &amp; Machinery used in the trade. Health &amp; Safety: Introduction to safety equipments and their uses. Introduction of first aid, operation of Electrical mains.</p> <p><b>Occupational Safety &amp; Health</b> <b>Importance of housekeeping &amp; good shop floor practices.</b> Health, Safety and Environment guidelines, legislations &amp; regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction, Personal protective Equipments(PPE):- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution &amp; personal safety message. Preventive measures for electrical accidents &amp; steps to be taken in such accidents. 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 Industrial Training Institute system including stores procedures. <b>Soft Skills: its importance and Job area after completion of training.</b> Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept &amp; its application. Response to emergencies eg; power failure, fire, and system failure.</p>
<b>2</b>	<p><b>Basic Fitting</b> Preparation of filing. Standing posture with respect to bench vice for filing. Marking lines on the job surface for filing to the marked lines. Gripping the job suitably in the vice jaws for filing. Balancing of file, using rough file. Measurement by using inside/outside calipers and scale.</p>	<p><b>Basic Fitting</b> Vice – purpose, types, description, size, construction method to use and maintenance. File – purpose, types, description, size and method to use. Use of file card, printing of file, convexity of file and proper filing technique. Rule – purpose, types, description and method to use.</p>

<p><b>3-4</b></p>	<p>Use of simple measuring instruments such as steel rule, Vernier caliper, Inside/Outside Micrometer. Care and precaution to be observed in handling these instruments.</p> <p>Exercises on measurement of various geometrical shapes.</p> <p>Exercise on marking out according to simple blue prints, using steel rule, scribe, marking blocks &amp; divider.</p> <p>Scribing lines on chalked or coloured (blue) surfaces of the work piece.</p> <p>Marking location of the position of holes &amp; scribing circles using dividers.</p> <p>Use of Dot and Center Punch for punching the lines, centers and circles.</p> <p>Demo on filing operation, using rough file.</p> <p>Exercise of filing flanges of a channel for balancing of file. Filing flat surface and flange of a channel maintaining parallelism between them using outside caliper within + or - 0.5mm.</p>	<p>Divider – purpose, types, description and method to use.</p> <p>Scribe – purpose, types, description and method to use.</p> <p>Marking Block – purpose, types, description and method to use.</p> <p>Punch – purpose, types, description and method to use.</p> <p>Micrometer – purpose, types, construction, calculation of least count, method to use and read, care and maintenance.</p> <p>Vernier Caliper – purpose, construction, calculation of vernier constant, method to use &amp; read, care and maintenance.</p>
<p><b>5</b></p>	<p>Exercises on filing to develop control and Field layout the dimensional features of the work piece using vernier height gauge, engineering square, angle plate and surface plate. Exercise on filing the adjoining sides Squareness with respect to one reference surface.</p> <p>Filing faces for maintaining flatness, square-ness of adjacent side using try- square, parallelism between opposite sides and reducing thickness.</p> <p>Filing with second cut file to prepare smooth surfaces.</p> <p>Exercise on filing for maintaining dimensions within + or - 0.1mm using vernier caliper.</p>	<p>Vernier height gauge – purpose, types, Construction, method to use and read, care and maintenance.</p> <p>Engineer’s square – purpose, description and method to use.</p> <p>Surface Plate – purpose, description, method to use, care and maintenance.</p> <p>Angle Plate – purpose, description and method to use.</p>
<p><b>6</b></p>	<p>Marking of profiles – combination of straight lines, circles, arcs and angles using scale, divider height gauge, protractor, combination set etc.</p> <p>Marking geometrical profiles on sheet metal and filing to mark lines.</p> <p>Sharpening of marking tools, use of bench grinder for sharpening of scribe, centre punch, dot punch, divider etc.</p> <p>Marking on the job piece for saw cuts.</p> <p>Gripping the job suitably in the vice jaws for hack sawing to dimensions.</p> <p>Hack sawing various metallic pieces (mild steel, aluminum, copper, brass, stainless steel etc.) of different thickness</p>	<p>Combination set – purpose, description and method to use. Vernier bevel protractor – purpose, description, calculation of vernier constant, method to read and use, care and maintenance.</p> <p>Bench Grinder – purpose, description, procedure and precautions to be observed during grinding of marking tools, chisels and drill bits.</p> <p>Hack saw – purpose, types, description, method to use and precautions to be taken during hack sawing.</p> <p>Hack saw blade – purpose, types, description, select ON/OFF</p>

	<p>and cross sections, within + or - 0.5mm using hack saw blades of different pitches. Hack sawing different lengths with hack saw frame in horizontal &amp; vertical positions Sawing along the parallel marked lines within 0.5mm allowance for filing. Hack sawing and filing steps and slots and open fitting of finished pieces.</p>	<p>appropriate grade, fixing of blade and precautions to be observed.</p>
7	<p>Hammering practice on vertical hold round job. Blind hammering practice. Stamping letters and numbers on M.S. plates. Exercise on stamping to develop judgment, control on hand and feel. Stamping practice on flat and round surfaces using flat, cross cut and round nose chisels for chipping edges and square to the faces and edges. Checking with Try- square, use of cross peen hammer for stretching of metal strip.</p>	<p>Hammer – purpose, types, description, method to use and precautions to be observed. Bending of solid selections using fixtures. Letters and Numbers – purpose, description, method to use and precautions to be observed. Hollow Punch – purpose, description, method to use for preparations of gaskets and other packing materials. Pipe Fitting – material and types of pipes used in the trade. Method to cut, to thread and preparation of pipes for ‘T’ fitting elbow fitting, reducers etc. using unions. Method to fill ferrule.</p>
8-9	<p>Preparation for drilling, marking out the position of holes and dot punching. Deepening the points with centre punch. Checking for centre distance. Drilling practice on sensitive drilling machine using different types of drills and drill holding devices. Safety to be observed while working on drilling machine. Marking, chain drilling and filing to produce square, round and triangular openings on 6mm thick plate. Preparing inserts and fitting in these openings. Drilling practice on varying thickness and different materials such as M.S., C.I., S.S., Cu, Brass, Nylon, Epoxy etc. Drilling on sheet metal, precautions and safety to be observed. Counter Sinking, counter boring, and spot facing operations using bench drilling machine. Exercise on reaming with hand reamers and machine reamers. Internal threading by hand using tap sets. External threading by split die and finishing of thread by die nut. Marking centre of a round bar with the help of ‘V’ block and clamp. Drilling and reaming of blind holes along the axis of round jobs. Grinding of drills to specifications and checking of angles with gauges. Grinding of chisels.</p>	<p>Drills – purpose, types, description, drill holding devices, method to use a drill with or without drill chuck (or collet) and precaution to be observed. Reamer – purpose, types, description, method to use, reaming allowance, coolant used and precautions to be observed during reaming. Drilling Machine with manual infeed, its purpose, types, description, drilling fixtures, method to drill and precautions to be observed during drilling. Procedure to be followed for counter sinking, counter boring, spot facing and reaming using bench drilling machine. Screw Threads – elements and forms screw threads single and multi-start thread, right and left hand thread. Taps and Tapping – purpose, types, description, precaution to be observed and method to use hand and machine taps during tapping. Types of coolant to be used. Calculation to drill size for tapping. Method to tap a blind hole, reasons for breakage of tap and method to remove broken tap. Construction and method to use tap wrench. Die and dieing purpose, types, description and method to use and precaution to be observed. Description of die stock, procedure and precautions to be observed during dieing.</p>
10	<p>Measurement of shaft and hole diameters using outside and inside micrometer. Filing round out of square bar within <math>\pm 0.1</math>mm. Filing to an</p>	<p>Defining and explanation of the elements of interchangeable system basis size, limits, tolerance, allowances. System of limits, fit and</p>

	accuracy of $\pm 0.1\text{mm.}$ , checking with an outside micrometer. Preparation of plates for a gauge fitting. Exercise on filing radius and angular filing using templates and gauges. Filing templates and gauges for checking lathe tool angles. Exercise on step and taper turning.	tolerances types of fit. Hole basis and shaft basis. Newal, British, I.S.I./B.S.I. systems, examples of fixing limit for various types of fit commonly met within the machine.
11	Filing of various angle & clearances of lathe tool on square blanks. Checking with templates & gauge already prepared. Use of combination & round nose pliers to make different shapes/profiles by bending wire to match the blue print to develop manipulative skills, hand control & eye judgment. Cold riveting. Marking out location of holes for riveting. Use of dolly and snap for forming rivet heads. Lap and butt joint by cold riveting.	Gauges & Template-purpose, types, description and method to use dial test indicator. Limit gauges - purpose, types, construction and method to use limit gauges.
12	Cutting of sheet metal with chisel. Marking parallel clamp, 'C' clamp or micrometer stand using acquired skills. Simple project work.	Sheet metal work-purpose, types, description and method to use snip & stake. Description and method to use hand shear. Rivets & riveting-types & description of rivets. Method of lap & butt joint using dolly and snap. Cold & hot working of strips & pipes-method of bending solid sections, using fixtures for different physical conditions. Use of cutters for pipes & method to bend in hot and cold condition using fixtures.
13	<b><u>BASIC MAINTENANCE SKILLS</u></b> Using hand tools such as screw driver, single end/double end spanners, box nut spanners, ratchet spanners, circlip, pliers, wrenches, pullers, extractors, drift. Correct method to be used and care to be taken in using those tools. Lubrication of different parts of machines. Care and maintenance of machines.	<b><u>BASIC MAINTENANCE SKILLS</u></b> Screw drivers – purpose, types, description and method to use screw drivers. Spanners – purpose, types, description and method to use box, socket, tubular, hook spanner etc. Wrenches – purpose, types, description and method to use T-socket, monkey, ratchet, pipe wrenches etc. Purpose, description, precautions to be observed and method to use drift, pullers and extractors.
14-17	<b><u>BASIC TURNING</u></b> Safety precautions to be observed while handling machines. Demonstration of change gear in the gearbox. Practice of holding work piece and tool using different devices. Exercises on plain, stepped, taper and form turning, knurling etc. Exercises on drilling, reaming, boring, counter boring etc. Screw thread cutting both internal and external of different types. Exercise on eccentric turning. Grinding of lathe tools.	<b><u>TURNING</u></b> Types, construction features working principles, functions, use accessories and attachments of lathe machine. Driving mechanism – cone pulley, all geared headstock, quick-change gearbox and apron mechanism. Types, materials and angles of the lathe cutting tools. Purpose and method to perform various lathe operations. Using accessories and attachments. Determination and use of cutting speed, feed.

	Simple projects such as hollow punch, pulleys, gear blanks, simple coupling etc.	Coolant and its applications. Lubrication system. Periodical maintenance of Lathe.
<b>18-22</b>	<p><b><u>BASIC MILLING</u></b></p> <p>Safety precautions in handling machine. Demonstration of various parts of the milling machines. Practice on different work and tool holding devices. Exercises on:</p> <ol style="list-style-type: none"> <li>i) parallel and angular milling.</li> <li>ii) grooving using mills.</li> <li>iii) Milling square/hexagon using indexing head.</li> <li>iv) Use of slotting attachment for cutting key ways.</li> <li>v) Simple projects such as jaw, claw, Oldham coupling, spline cutting etc.</li> </ol> <p>Lubrication of different parts. Care and maintenance of machine.</p>	<p><b><u>MILLING :</u></b></p> <p>Construction features, working principles, types, functions. Use of accessories and attachment of milling machine. Types of milling cutters. Different method of holding work piece and cutters. Milling operations such as plain, step, angular milling, slot and groove cutting. Gear nomenclature – definitions, symbols, explanation and gear cutting calculations. Explanation of cutting speed, feed and depth of cut. Coolant for different materials. Common fault, defects and their rectification.</p>
<b>23&amp;24</b>	<b>In plant training/Project work</b>	
<b>25</b>	<b>Revision</b>	
<b>26</b>	<b>Examination</b>	



# SYLLABUS FOR THE TRADE OF OPERATOR ADVANCE MACHINE TOOL

## Second Semester

(Semester Code no. OAM - 02)

Duration : Six Month

Week No.	Trade Practical	Trade Theory
1 -5	<p><b><u>GRINDING</u></b></p> <p>Safety precautions to be observed while using machine</p> <p>Demonstration of various parts of the grinding machines.</p> <p>Use of drive – both mechanical and hydraulic.</p> <p>Grinding wheel specifications, mounting, balancing, truing and dressing of grinding wheels.</p> <p>Lubrication of different parts and care &amp; maintenance of grinding machine.</p> <p>Practice on different work holding devices and grinding various jobs.</p>	<p>Types of machines- Constructional features, working principle, types, functions and use of surface and cylindrical grinding machine. Grinding wheels and their specifications – grit, grain, size, structure, bond, grades etc.</p> <p>Procedure to use grinding wheels for balancing and truing.</p> <p>Method to hold work and grind wheel.</p> <p>Method to perform various grinding operation selecting proper speed, Feed. Importance of coolant.</p> <p>Method to detect common faults, their rectification and preventive maintenance of grinding machine. Study of hydraulic system used on the machine.</p>
6	<p>Other machining processes:</p> <p>i) Shaping</p> <p>ii) Planning</p> <p>iii) Slotting</p> <p>iv) Hobbing</p> <p>v) Broaching</p> <p>vi) Finish machining process like</p> <ul style="list-style-type: none"> <li>• Types <ul style="list-style-type: none"> <li>• Coated Abrasives (Sandpaper, Emory Cloth)</li> <li>• Belt Grinders <ul style="list-style-type: none"> <li>• Solid Belt</li> <li>• Mesh Belt (Hold Grinding Fluid via Surface Tension)</li> </ul> </li> <li>• Wire Brushing <ul style="list-style-type: none"> <li>• Wire Provides Metal Cutting/Burnishing Action</li> <li>• Wire (Metal) Acts as Abrasive</li> </ul> </li> <li>• Honing (Interior of Holes)</li> <li>• Lapping (Flat Surfaces)</li> <li>• Polishing</li> <li>• Buffing</li> <li>• Electro-Polishing</li> <li>• Magnetic Float Polishing (Ceramic Ball Bearings)</li> <li>• Barrel Finishing</li> <li>• Abrasive Flow</li> </ul> </li> </ul>	

7-11	<p><b><u>ADVANCED MACHINING SKILLS TURNING</u></b></p> <ol style="list-style-type: none"> <li>1. Taper turning by using taper attachment.</li> <li>2. Taper turning by using a form tool.</li> <li>3. Internal and external taper turning and matching to mating parts.</li> <li>4. Eccentric turning practice.</li> <li>5. Boring and stepped boring, position boring.</li> <li>5. Various Screw thread cutting to suit male and female threaded components.</li> <li>6. Multi start threads cutting-2start.</li> </ol>	<p><b><u>ADVANCED MACHINING SKILLS TURNING</u></b></p> <p>Taper turning attachment and form tool. Care to be taken for boring, step boring and taper boring in a blind hole.</p> <p>Procedure for cutting various internal and external screw threads. Care to be taken during internal threading in a blind hole.</p> <p>Procedure and care to be taken eccentric turning.</p>
12-19	<p><b><u>MILLING</u></b></p> <ol style="list-style-type: none"> <li>1. Gang milling – milling jobs of different shapes and dimensions by using gang-milling process.</li> <li>2. Milling hexagonal holes on a plate by attachment.</li> <li>3. Milling splines (external).</li> <li>4. Milling gears by both simple and differential indexing</li> <li>5. Helical milling – milling helical groove on vertical milling machine by a slab mill cutter.</li> <li>6. Milling helical gears.</li> <li>7. Milling bevel gears.</li> <li>8. Milling a rack.</li> <li>9. Cutting worm and worm wheel on a milling.</li> </ol>	<p><b><u>MILLING</u></b></p> <p>Different types of milling operations. Indexing methods and its applications. Different types of gear &amp; its application.</p> <p>Different cutters used in gear cutting operations and cutter nomenclature.</p> <p>Procedures for milling helical groove by a slab mill cutter on vertical milling machine.</p> <p>Care and precautions to be taken during milling.</p> <p>Procedure for milling helical gears, bevel gears, rack, worm and worm wheel.</p>
20	<p><b><u>INSPECTION</u></b></p> <p>Familiarization with inspection and master gauge checking of finished product with limit gauges for their accuracy and usability. Use of Sine Bar, slip gauges along with standard balls and rollers for measurement of taper. Measuring with tool maker's microscope. Testing of gears for its measurements and accuracy. Use of profile projector.</p>	<p><b><u>INSPECTION</u></b></p> <p>Definition, description and use of worker's inspection and master gauge. Principle, construction and use of sine bar and sine center.</p> <p>Types and description of slip gauges, purpose, construction and method to use tool makers. Microscope and profile projector.</p>
21	<p>Geometrical accuracy test of machine as per test chart.</p>	<p>Defects and remedies of turning, milling and grinding.</p> <p>Defects such as: Taper, Chattering, Poor Surface finish, Parallelism.</p>
22&23	<b>In plant training/Project work</b>	
24-25	<b>Revision</b>	
26	<b>Examination</b>	

**SYLLABUS FOR THE TRADE OF  
OPERATOR ADVANCE MACHINE TOOL  
Third Semester  
(Semester Code no. OAM - 03)  
Duration : Six Month**

<b>Week No.</b>	<b>Trade Practical</b>	<b>Trade Theory</b>
1 -2	<b>CNC FUNDAMENTALS</b> Familiarization of computer as CNC works station. Communication between CNC and computer i.e. series, parallel port.	<b>CNC FUNDAMENTALS</b> Background application, block diagram, input devices, output devices, CPU. Memory, U se of computer as CNC workstation. Communication between CNC and computer. Introduction to CNC machine, Types, construction, Different elements of CNC machine, Comparison between conventional machines & CNC machines, Advantages & Dis-advantages of CNC machines. Axis designation.
3-5	Demo / Identification of different elements of CNC machine Construction & functions, Axis designation	Familiarization with co-ordinate system. Types of co-ordinate system and their applications. Different types/functions of G codes & M codes used in CNC part programming. Different types of interpolation & its applications.
6-9	Practice on exercises with different co-ordinate systems with linear & circular interpolation	Cutter Radius comp Tool wear comp Tool nose radius comp Tool nomenclature, tool change command, work & tool offset.
10-17	Writing the part program for both turning & milling manually and practice on simulation software. Selection of tools Practice of work & tool offset on simulator.	Introduction to part programming for both turning & milling using geometrical information & technological information (G & M codes) such as feed, speed, depth of cut,.
18-21	<b>CNC TURNING</b> Operating the CNC machine in different modes such as JOG, MPG, MDI/MDA. Procedure for reaching reference point. Practice on Work & Tool offset measurement. Program loading and machine setting. Executing the program in auto Single Block and auto continuous mode.	<b>CNC TURNING</b> Modes of operation such as JOG, MPG, REF, MDI/MDA. Program execution in different modes like auto SBL and auto cont. mode. Knowledge on CNC cutting tools-Geometry, material, cutting speed, feed, and depth of cut. Techniques of tool off-setting and tool setting. Prepare various programs as per drawing.
<b>22&amp;23</b>	<b>In plant training/Project work</b>	
<b>24</b>	<b>Revision</b>	
<b>25</b>	<b>Examination</b>	

# SYLLABUS FOR THE TRADE OF OPERATOR ADVANCE MACHINE TOOL

## Fourth Semester

**(Semester Code no. OAM - 04)**

**Duration : Six Month**

Sl. No.	Trade Practical	Trade Theory
1 to 5	Practice of contour program for different profiles on CNC simulation software	Concept of contour programming for different profiles.
6 to 8	Practice on CNC lathe. TURNING - parallel, taper, step, radius, groove and threads of different pitches.	Program for different cycles such as stock removal, Grooving, Threading, Undercut & canned/ fixed cycles Tool type chart, TNRC(G41 and G42). Surface finish-Primary and Secondary. Surface roughness related BIS symbols.
9 to 12	CNC MILLING Operating the CNC machine in different modes such as JOG, MPG, MDI/MDA. Procedure for reaching reference point . Practice on Work & Tool offset measurement. Program loading and machine setting. Executing the program in auto SBL and auto cont. mode.	CNC MILLING Modes of operation such as JOG, MPG, REF, MDI/MDA. Program execution in different modes like auto SBL and auto cont. mode. Knowledge on CNC cutting tools-Geometry, material, cutting speed, feed, and depth of cut. Techniques of tool off-setting and tool setting. Prepare various programs as per drawing.
13 to 17	Practice on CNC Milling such as Face milling, Edge milling, slot milling (Radial & circumferential), Pocket milling ( square & circular), Application of Canned/Fixed cycles	Programming for different operation such as Face milling, Edge milling, Slot milling(radial & circumferential) Tool type chart, Application and effect of Cutter radius compensation (G41 and G42). Surface finish-Primary and Secondary. Surface roughness related BIS symbols Programming for Pocket milling (square & circular) & Canned / Fixed cycles for hole machining.
18	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.
19 - 20	Practice of contour program for different profiles on CNC simulation software.	Concept of contour programming for different profiles.
21	Practice on routine maintenance, Periodic checking for lubrication, Hydraulic oil level, Hydraulic system pressure, chuck Pressure adjustment for different material. Cleaning & adjusting the Pneumatic Filter, Pressure regulator & Lubricator.	<b>Preventive Maintenance, Predictive Maintenance &amp; Concepts of TPM.</b> Difference between breakdown and preventive maintenance – Its importance in productivity, types. Normal procedure followed for maintenance of machine tool in the shop floor. Importance of centralized lubrication system, Hydraulics & pneumatics.

<b>22&amp;23</b>	<b>In plant training/Project work</b>
<b>24</b>	<b>Revision</b>
<b>25</b>	<b>Examination</b>

# TRADE: OPERATOR ADVANCE MACHINE TOOL

## LIST OF TOOLS & EQUIPMENTS FOR 12 TRAINEES + 1

### A. Trainees Kit –

Sl. No.	Name of the Items	Quantity
1.	Screw drivers 150 mm	13 nos.
2	Screw driver star	2 set
3.	Long nose plier 150mm.	13 nos.
4.	Combination plier 150mm.	13 nos.
5.	Diagonal cutter 150mm.	13 nos.
6.	Adjustable spanner or side wrench	13 nos.
7	Hack saw frame adjustable 250 – 300mm. with blades	13 nos.
8	Flat file 200mm.	13 nos.
9	File triangular 150 mm.	13nos.
10	Half round file 150 mm	11 nos
11	Square file 150 mm	11 nos.
12	Ring spanner set	2 sets
13	Box spanner set	2 sets
14	Hammer cross pane 750 gms. With handle	11 nos.
15	Hammer small 250gms. With handle	11 nos.
16.	Neon tester	2 nos.
17	Grease Gun	1 nos.
18	Bearing Extractor	1 no.

### B. LIST OF TOOLS & EQUIPMENT

Sl. No.	Item	Quantity
1.	Steel rule 30 cm. Graduated both in English and Metric unit.	11 nos.
2.	Outside spring caliper 150mm.	11 nos.
3.	Inside spring caliper 150mm.	11 nos.
4.	Hermaphrodite caliper 150mm.	6 nos.
5.	Divider spring 150mm.	6 nos.
6.	Center punch 100mm.	11 nos.
7.	Prick punch 100mm.	11 nos.
8.	Scraper A 250mm. (bearing).	11 nos.
9.	Scraper B 250mm. (triangular).	11 nos.
10.	ScraperC250mm. (half round).	11 nos.
11.	Scriber 150x3mm. (one side offset).	11 nos.
12.	Cold chisel 20x 200mm.	11 nos.
13.	Cross chisel 10x 150mm	11 nos.
14.	Diamond point chisels 10x 150mm.	11 nos..
15.	Safety glasses.	21 nos.
16.	Flat 2 <sup>nd</sup> .Cut 250mm.	11 nos.
17.	Chisel flat 25x 200mm.	11 nos.
18.	Surface plate 400mm.X 400mm. Grade 1. With stand	2 nos.
19.	Marking off table 1200x 1200x 900mm.	1 no.
20.	Scribing block universal 300mm.	1 no.
21.	Vee block 100/7-80-A	11 nos.
22.	Try square 300mm.	11 nos.
23.	Out side spring caliper 200mm	11 nos.

24.	Divider spring 200mm.	11 nos.
25.	Inside spring caliper 200mm.	11 nos.
26.	Straight edge steel meter	2 nos.
27.	Straight edge steel 500mm.	2 nos.
28.	Steel tape 2 meter in case	1 no.
29.	Sprit level 2V 250, 05 meter	2 nos.
30.	Combination set 300mm.	3 nos.
31.	Hexagonal allen keys 2.5 to 12mm.	11 sets
32.	Spanner D.E. 6mm to 32mm assorted	6 sets
33.	Adjustable spanner 300mm.	6 nos.
34.	Reduction sleeve Morse 1-2, 2-3, 3-4, 2-4	5 sets
35.	Angle plate adjustable 250x 150x 175mm.	5 nos
36.	Solid parallels in pairs (different sizes)metric	13 nos.
37.	Oil can pressure feed 500mg.	6 nos.
38.	Oil stone 150x 50x 25mm.	3 sets
39.	Number drills HSS (parallel shank)	3 sets
40.	Drill (parallel)	3 sets
41.	Twist drills 3mm. To 13mm. (parallel shank)	3 sets
42.	Drill chuck 0-12mm with taper shank	3 sets
43.	Centre drill A 1 to 5	2 nos.
44.	Grinding wheel dresser (diamond)	2 nos.
45.	Grinding wheel dresser (hunting tone type)	12 nos.
46.	Clamp C 100mm.	12 nos.
47.	Clamp C 200mm.	5 nos
48.	Tap and die set in box metric pitch	3 sets
49.	Drill HSS taper shank	12 nos.
50.	Needle file set	5 set.
51.	Reamer 6mm. to 25mm. by 1mm.	2 set
52.	Reamer adjustable 10mm. to 15mm. by 75mm.	2 set
53.	Tool bits HSS 6mm. square	1 doz.
54.	Tool bits HSS 10mm. square	1 doz.
55.	Tool bits holder (Amstrong) LH	12 nos.
56.	Tool bits holder (Amstrong) RH	12 nos.
57.	Assorted tools for lathe, shaper, slotter & planner of different shapes & sizes.	8 nos. each
58.	Table chuck 75mm. jaw swivel base	2 nos.
59.	Machine vice 200mm. swivel base	4 nos.
60.	Machine vice 160mm. swivel base	2 nos.
61.	Hand vice 50mm. jaw	6 nos.
62.	Compound angle vice (standard sine)	3 nos.
63.	Universal sine	3 nos.
64.	Universal table angle plate	3 nos.
65.	Shaper tool holder turret type	3 nos.
66.	Shaper indexing center	1 no.
67.	Knurling tools (set of 3) straight and diamond	1 each for 12 trainees
68.	Plier cutting 200mm.	2 nos.
69.	Magnifying glass 75mm.	2 nos.
70.	Carbide tipped tools of different sizes & shapes (throw away tips)	3 sets

**C. Milling Cutters:**

Sl. No.	Item	I.S. Code No.	Quantity
1.	Cylindrical cutter ( different sizes and as per the arbor of the machine)	IS : 1831-1961	20 nos.
2	Side and face cutter ( different sizes and as per the arbor of the machine)	IS : 6308-1971	20 nos.
3	Equal angle cutter ( different sizes and as per the arbor of the machine)	IS : 6326-1971	20 nos.
4.	Double angle unequal cutter ( different sizes and as per the arbor of the machine)	IS : 6325-1971	20 nos.
5.	Single angle cutter LH & RH ( different sizes and as per the arbor of the machine)	IS: 6324-1971	20 nos.
6.	End mill cutter – Dia. 6 mm - 20 mm ( in steps of 2 mm )	IS : 6352-1971	2 sets.
7	Shell end mill cutter Dia. 32 mm & 50 mm each 2 nos.		2 sets
8.	Slitting saw ( different sizes and as per the arbor of the machine)	IS : 5031-1969	10 nos.
9.	Slot drill (key seating) 4 mm to 12 mm in steps of 2 mm		3 sets.
10.	T-slot cutter to suit T-headed bolt of 10, 12mm. straight shank	IS : 2668-1964	6 nos.
11.	T-slot cutter to suit T-headed bolt of 12, 18, 22mm. taper shank	-do-	6 nos.
12.	Milling cutters (involute) DP-8, 10, 12, 16& 20, No.1 to8	-do-	12 nos.
13.	Milling cutters (involute) 1, 2, 2.5,3&4	-do-	12 nos.
14.	Convex milling cutter 2.5mm, 4mm, 10mm.,20mm	IS : 6323-1964	12 nos.
15.	Concave milling cutter R-2.5mm, 4mm, and 10mm.	IS : 6329-1964	12 nos.
16.	Milling cutter R-2.5mm, 4mm, 10mm, and 16mm.		12 nos.
17.	Milling cutter face mill inserted type 100x 27 bore		12 nos.
18.	Milling cutter face mill inserted type 150x 32 bore		12 nos.

**D. Measuring Instruments:**

Sl. No.	Item	I.S. Code No.	Quantity
1.	Micrometer Outside 0-25mm.	IS : 2967-1964	6 nos. each
2.	Micrometer Outside 25-50mm.	-do-	
3.	Micrometer Outside 50-75mm.	-do-	
4.	Micrometer depth gauge 0-200mm.		
5.	Direct reading vernier caliper B 300 (direct reading with dial)	IS : 3651-1964	
6.	Vernier height gauge 250mm.	IS : 2961-1964	
7.	Vernier gear tooth caliper		2nos.
8.	Vernier bevel protractor with 150mm. blade	IS : 4239-1970	2 nos.
9.	Bevel gauge 200mm		2 nos.
10.	Telescopic gauge 13mm. to 300mm.		2 nos.
11.	Sine Bar 200mm.	IS : 5359-1969	3 set
12.	Dial test indicator with magnetic gauge type1 gradeA with magnetic base	IS : 2092-1069	2 nos
13.	Centre gauge 60 <sup>0</sup>		2 nos.
14.	Slip gauge set (normal set)	IS: 2984-1966	6 nos.
15.	Screw pitch gauge for metric pitches	IS : 4211-1967	1 set
16.	Radius gauge metric set	IS : 5273-1969	2 set
17.	Limit plug gauges 5mm. to 25mm.	IS : 2251-1965	2 set
18.	Ring gauges 5mm to 25mm. by 2.5mm (Go& No Go)	-do-	2 set
19.	Taper gauge M.T. No. 1, 2, 3,4&5		2 set
20.	Feeler gauge	IS:3179-1965	2 set
21.	Planer gauge standard size		2 set



### E. General Furniture

Sl. No.	Item	I.S. Code No.	Quantity
1	Steel lockers for 20 trainees	IS:3314-1965	1 no.
2	Steel chair for instructor		2 nos.
3	Steel table for instructor		1 no.
4	Work bench for fitters with four vices of 100mm. jaw		5 nos.
5	Steel cupboard 180x 90x 45cm.	IS:1883-1966	12 nos.
6	Steel cupboard 120x 60x 45cm.	-do-	12 nos.
7	Black board with easel		1 no.
8	Computer table and chair		10 sets
9	FirstAid Box		1 no.

### F. General Machinery Shop Out Fit

Sl. No.	Name & Description of Machines	I.S. Code No.	Quality
1.	Lathe S.S & S.C.(all geared type) with minimum specification as: 150 mm center height, 1000 mm between centers, along with 4-jaw & 3-jaw chucks, auto feed system, taper turning attachment, Motorized coolant system, safety guard, dog carriers, face plate and machine light arrangement.		3 nos.
2.	Drilling machine pillar type 20mm. capacity with drill chuck & key.	IS:6893-1973	1 no.
3.	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 c. Rack cutting attachment d. Rotary table e. Dividing head  Adaptors, arbors and collects etc. for holding straight shank drills and cutters from 3 mm to 25 mm.		1 no.
4.	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.	IS:6893-1973	2 nos.
5.	Surface grinding machine wheels dia.180mm. Reciprocating table, longitudinal table traverse 200mm fitted with adjustable traverse stop. Full motorizedsuppliedwithmagneticchuck250mm.x120mm. diamond tool holder, set of spanner, grease etc.		1 no.
6.	Cylindrical grinding machine with internal grinding attachments with minimum specification as: To accommodate 750mm job with centre height 150mm. Wheel diameter x width = 300 x 25mm.		1No
7. @	CNC lathe/CNC turn Centre with minimum specification as: Chuck size:135mm		2 no

	Between centre distance: 250mm Travel in X: 100mm Travel in Z: 200mm No. of tool stations: 8 station turret Spindle power: 3.7kW (continuous rating) preferably with popular control system like Fanuc/Siemens or equivalent along with motorized coolant system.		
8. @	CNC Milling Machine/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 or equivalent along with motorized coolant system.		2 nos.
9. @	a) Multimedia based simulator 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 trainees + 1 faculty)		a)11 user
10.	Desktop with MS-Windows-7 or latest to run above software, networked on LAN.		10 nos
11.	LCD projector		1no

**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. (@)-Only one number need be provided in each I.T.I. irrespective of No. of Units.
3. Institute having centralized computer lab may use the existing infrastructure to impart simulation training & in that case not required to procure item no. 10a

## LIST OF TRADE EXPERT COMMITTEE MEMBERS

Sl. No.	Name & Designation Sh/Mr/Ms.	Organization	Mentor Council Designation
<b>Members of Sector Mentor council</b>			
1.	A. D. Shahane, Vice-President, (Corporate Trg.)	Larsen & Tourbo Ltd., Mumbai:400001	Chairman
2.	Dr. P.K.Jain, Professor	IIT, Roorkee, Roorkee-247667, Uttarakhand	Member
3.	N. Ramakrishnan, Professor	IIT Gandhinagar, Gujarat-382424	Member
4.	Dr. P.V.Rao, Professor	IIT Delhi, New Delhi-110016	Member
5.	Dr. Debdas Roy, Asstt. Professor	NIFFT, Hatia, Ranchi-834003, Jharkhand	Member
6.	Dr. Anil Kumar Singh, Professor	NIFFT, Hatia, Ranchi-834003, Jharkhand	Member
7.	Dr. P.P.Bandyopadhyay Professor	IIT Kharagpur, Kharagpur- 721302, West Bengal	Member
8.	Dr. P.K.Ray, Professor	IIT Kharagpur, Kharagpur- 721302, West Bengal	Member
9.	S. S. Maity, MD	Central Tool Room & Training Centre (CTTC), Bhubaneswar	Member
10.	Dr. Ramesh Babu N, Professor	IIT Madras, Chennai	Member
11.	R.K. Sridharan, Manager/HRDC	Bharat Heavy Electricals Ltd, Ranipet, Tamil Nadu	Member
12.	N. Krishna Murthy Principal Scientific Officer	CQA(Heavy Vehicles), DGQA, Chennai, Tamil Nadu	Member
13.	Sunil Khodke Training Manager	Bobst India Pvt. Ltd., Pune	Member
14.	Ajay Dhuri	TATA Motors, Pune	Member
15.	Uday Apte	TATA Motors, Pune	Member
16.	H B Jagadeesh, Sr. Manager	HMT, Bengaluru	Member
17.	K Venugopal Director & COO	NTTF, Peenya, Bengaluru	Member
18.	B.A.Damahe, Principal L&T Institute of Technology	L&T Institute of Technology, Mumbai	Member
19.	Lakshmanan. R Senior Manager	BOSCH Ltd., Bengaluru	Member
20.	R C Agnihotri Principal	Indo- Swiss Training Centre Chandigarh, 160030	Member
<b>Mentor</b>			
21.	Sunil Kumar Gupta (Director)	DGET HQ, New Delhi.	Mentor
<b>Members of Core Group</b>			
22.	N. Nath. (ADT)	CSTARI, Kolkata	Co-ordinator
23.	H.Charles (TO)	NIMI, Chennai.	Member
24.	Sukhdev Singh (JDT)	ATI Kanpur	Team Leader

25.	Ravi Pandey (V.I)	ATI Kanpur	Member
26.	A.K. Nasakar (T.O)	ATI Kolkata	Member
27.	Samir Sarkar (T.O)	ATI Kolkata	Member
28.	J. Ram Eswara Rao (T.O)	RDAT Hyderabad	Member
29.	T.G. Kadam (T.O)	ATI Mumbai	Member
30.	K. Mahendar (DDT)	ATI Chennai	Member
31.	Shrikant S Sonnavane (T.O)	ATI Mumbai	Member
32.	K. Nagasrinivas (DDT)	ATI Hyderabad	Member
33.	G.N. Eswarappa (DDT)	FTI Bangalore	Member
34.	G. Govindan, Sr. Draughtsman	ATI Chennai	Member
35.	M.N.Renukaradhya, Dy.Director/Principal Grade I.,	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
36.	B.V.Venkaatesh Reddy. JTO	Govt. ITI, Tumkur Road, Banglore, Karnataka	Member
37.	N.M.Kajale, Principal,	Govt. ITI Velhe, Distt: Pune, Maharashtra	Member
38.	Subrata Polley, Instructor	ITI Howrah Homes, West Bengal	Member
39.	VINOD KUMAR.R Sr.Instructor	Govt. ITI Dhanuvachapuram Trivendrum, Dist., Kerala	Member
40.	M. Anbalagan, Assistant Training Officer	Govt. ITI Coimbatore, Tamil Nadu	Member
41.	K. Lakshmi Narayanan, T.O.	DET, Tamil Nadu	Member
<b>Other industry representatives</b>			
42.	Venugopal Parvatikar	Skill Sonics, Bangalore	Member
43.	Venkata Dasari	Skill Sonics, Bangalore	Member
44.	Srihari, D	CADEM Tech. Pvt. Ltd., Bengaluru	Member
45.	Dasarathi.G.V.	CADEM Tech. Pvt. Ltd., Bengaluru	Member
46.	L.R.S.Mani	Ohm Shakti Industries, Bengaluru	Member