



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

**COMPETENCY BASED CURRICULUM**

**CERTIFICATE COURSE ON**

# **CNC MACHINIST 3-AXIS**



**NSQF LEVEL- 5**

**SECTOR : STRATEGIC MANUFACTURING**

# CNC MACHINIST 3-AXIS

**Duration: 960 Hours**

**NSQF LEVEL - 5**

**(Version: 1.0)**

**Designed in 2020**

**Developed By**

Ministry of Skill Development and Entrepreneurship  
Directorate General of Training

**Sectoral Trade Course Committee of Strategic Manufacturing Sector**

**&**

**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**

EN-81, Sector-V, Salt Lake City,  
Kolkata – 700 091

## CONTENTS

S No.	Topics	Page No.
1.	Course Information	04
2.	Job Role	06
3.	General Information	07
4.	Learning Outcome	08
5.	Trade Syllabus	09
6.	Assessment Criteria	19
7.	Annexure I - List of Trade Tools & Equipment	22
8.	Annexure II - List of Trade experts	30

## 1. COURSE INFORMATION

---

### 1.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of the economy/ labour market. The vocational training programs of short term duration are intended for up skilling of NTC/ NAC pass out candidates. After passing out of the course, the trainee is awarded a competency based certificate approved by DGT.

In terms of Skilling and up-skilling of ITI workforce in industries and Instructors and trainees in ITI ecosystem, the CNC Machinist 3-Axis Short term training (STT) under Strategic Manufacturing Sector is one of the high demand job role which penetrates more employment and entrepreneurship delivered nationwide through a network of ITIs.

CNC Machinist 3-Axis is of 960 Hours of duration and will be offered as add on course after completing ITI in Machinist, Machinist (Grinder), Turner, Operator Advance Machine Tool, Tool & Die Maker (Dies & Moulds) and Tool & Die Maker (Press Tool, Jigs & Fixture) trade courses under CTS/ATS.

In this course, During the Six Months duration, a candidate is trained on subjects - Professional Skill, Professional Knowledge related to CNC Machinist 3-Axis Job Role. The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task. The broad components covered under Professional skill subject are as below:

Module 1: In this module, the course contents covered are from Safety Precautions, Manufacturing Process & Surface finish, Reading of Engineering Drawing, Basic Metrology, Heat Treatment & Material Testing, Cutting Tools & Cutting Tool Parameters, Conventional Machining.

Module 2: In this module, the course contents covered are from Process Planning, Auto CAD basics, Master CAM basics, CNC Part Programming for 3-Axis, CNC machine Operation & Project Work, CNC machine Maintenance Concepts.

### 1.2 PROGRESSION PATHWAYS

- Can join industry as Technician and will progress further as Senior Technician, Supervisor and can rise to the higher levels.
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Can join Advanced CNC Machinist 5-axis course for further up skilling and better employment and entrepreneurship opportunities.

### 1.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements: -

S No.	Course Element	Notional Training Hours
1.	Professional Skill (Trade Practical)	720
2.	Professional Knowledge (Trade Theory)	240
	<b>Total</b>	<b>960</b>

### 1.3 ASSESSMENT & CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The Continuous Assessment (Internal) during the period of training will be done by Formative Assessment Method by testing for assessment criteria listed against learning outcomes. The training institute has to maintain an individual trainee portfolio as detailed in assessment guideline.

b) The pattern and marking structure is being notified by DGT from time to time. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment.

c) Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop/Field
- Answer sheet of assessment
- Viva-voce
- Participation and punctuality

Evidences of internal assessments are to be preserved until forthcoming examination for audit and verification by examining body.

d) The minimum pass percentage for skill test is 60%.

## 2. JOB ROLE

---

### **Brief description of Job roles:**

#### **CNC Machinist (3-Axis)**

CNC Machinist 3-Axis produces machined parts by programming, setting up, and operating different computer numerical control (CNC) machines, maintaining quality and safety standards, keeping records, maintaining equipment and supplies.

CNC Machinist 3-Axis makes and load the programs for various machines like vertical machining center, horizontal machining center, CNC turning center, etc. Study drawings and measures the raw material required for the job to be machined. Study different dimensions of the job and required sequence of operations. Fastens raw material in chuck, jig or other fixture and respective tool or cutter, according to sequence of operation, on appropriate machine. Checks machine setting or sets it for stipulated machine operations. Controls flow of coolant (cutting lubricant). Start the program cycle and applies automatic controls to feed tool to metal for machining.

After machining, checks completed part with measuring instruments and gauges to ensure prescribed accuracy. Makes report of the measured dimensions and accuracies. May assist in setting up machine for repetitive work, change tools, make simple adjustments, clean and oil the machine. Does process planning, tool & cutting parameters selection, programming, setup & operation for cutting parts on CNC vertical machining center and CNC turning center. Maintains the CNC Machines by checking the alarms, oil levels, oil pressures, coolant level, also preventive and routine maintenance. He should follow the safety precautions and fulfill the job role of CNC machinist in all respects.

### 3. GENERAL INFORMATION

<b>Name of the Trade</b>	<b>CNC MACHINIST 3-AXIS</b>	
<b>Course Code</b>	DGT/8005	
<b>Reference NCO - 2015</b>	7223.5003, 7223.5005, 7223.6001, 7223.6003	
<b>NSQF Level</b>	Level - 5	
<b>Duration of Craftsmen Training</b>	960 Hours	
<b>Entry Qualification</b>	1. ITI pass in Machinist, Machinist (Grinder), Turner, Operator Advance Machine Tool, Tool & Die Maker (Dies & Moulds) and Tool & Die Maker (Press Tool, Jigs & Fixture) trade 2. ATS in CNC Programmer cum Operator	
<b>Unit Strength (No. of Student)</b>	20	
<b>Space Norms</b>	130 SQ. M	
<b>Power Norms</b>	20 KW	
<b>Instructors Qualification for:</b>		
<b>(i) CNC MACHINIST 3-AXIS</b>	B.Voc./Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field of CNC Programming and operation. OR 03 years Diploma in Engineering from AICTE/ recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field of CNC Programming and operation. OR NTC/ NAC in above relevant trades with three years' experience in CNC Programming and Operation.	
<b>List of Tools and Equipment</b>	As per Annexure – I	
<b>Distribution of training on hourly basis: (Indicative only)</b>		
<b>Total hours/Week</b>	<b>Trade practical</b>	<b>Trade theory</b>
40	30	10

## 4. LEARNING OUTCOME

---

***Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.***

### 4.1 LEARNING OUTCOMES

1. Exhibit different workshop safety measures and use PPE & First aid kit.
2. Demonstrate various types of manufacturing processes and achievable surface finish values.
3. Demonstrate reading and drawing of Engineering drawing.
4. Check accuracy of component with appropriate measuring instruments and prepare reports.
5. Demonstrate Heat treatment processes and perform testing of the materials
6. Select cutting tools for proper usage.
7. Perform various types of drilling operations.
8. Perform various types of milling operations.
9. Perform various types of turning operations.
10. Perform various types of grinding operations.
11. Prepare Process plan and sequence of operations.
12. Make 2D Drawings in AutoCAD
13. Create and analyze programs in Master CAM and post process to CNC machine.
14. Understand the elements of CNC Machine.
15. Write basic programs and execute the programs for different operations for turning center.
16. Write basic programs and Execute the programs for different operations for Machining center.
17. Execute Project work on CNC Turning and Machining Centers.
18. Perform basic CNC Maintenance.



## 5. TRADE SYLLABUS

<b>Course: CNC Machinist 3-Axis</b>			
<b>Index: Contents</b>			
<b>Sl. No</b>	<b>Topic</b>	<b>Professional Knowledge (Trade Theory) in Hours</b>	<b>Professional Skill (Trade Practical) In Hours</b>
<b>Module 1: Three Months</b>			
1.	Safety Precautions	10	30
2.	Manufacturing Process & Surface finish	10	30
3.	Reading of Engineering Drawing	20	60
4.	Basic Metrology	10	30
5.	Heat Treatment & Material Testing	10	30
6.	Cutting Tools & Cutting Tool Parameters	10	30
7.	Conventional Machining	50	150
<b>Module 2: Three Months</b>			
8.	Process Planning	20	60
9.	Auto CAD basics	20	30
10.	Master CAM basics	20	60
11.	CNC Part Programming 3-Axis	20	90
12.	CNC Operation & Project Work	30	90
13.	CNC Maintenance Concepts	10	30

**SYLLABUS – CNC MACHINIST 3-AXIS**

**Duration: 960 Hours**

<b>Duration</b>	<b>Reference Learning outcome</b>	<b>Professional Skills (Trade Practical)</b>	<b>Professional Knowledge (Trade Theory)</b>
Professional Skill:30 Hours  Professional Knowledge: 10 Hours	Exhibit different workshop safety measures and use PPE & First aid kit.	<b>1. <u>Safety Precautions</u></b>  1. Follow Health, Safety and Environment guidelines, Legislations & regulations as applicable. Dispose the waste material as per procedure. 2. Ensure Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning caution & personal safety. 3. Use Preventive measures for Electrical accidents & steps to be taken in such accidents. 4. Use of Fire extinguishers.	<b><u>Safety Precautions</u></b>  1. Introduction of First Aid. 2. Operation of electrical mains. 3. Effective usage of PPEs. 4. Response emergencies e.g.: power failure, fire, and system failure. 5. Introduction to 5S concept & its application. Importance of 5S implementation. 6. <b>Basic Life Support (BLS):</b> Basic Life Support (BLS) techniques for drowning, choking, electrocution, neck and spinal injury, including CPR (Cardio Pulmonary Resuscitation).
Professional Skill: 30 Hours  Professional Knowledge: 10 Hours	Demonstrate various types of manufacturing processes and achievable surface finish values.	<b>2. <u>Manufacturing Process &amp; Surface finish:</u></b>  1. Demo on various (Drilling, Turning, Milling, Grinding, etc) machines. 2. To Select Materials& cutting tools for Manufacturing. 3. Practice of Machining Processes. 4. Practice on Grinding	<b><u>Manufacturing Process &amp; Surface finish.</u></b>  1. Types and Classification of Manufacturing Processes& Material Selection 2. Properties of Materials & Machinability. 3. Conventional Machining Processes: Turning, Milling, Drilling, Boring, Grinding 4. Awareness on Non-Conventional Machining Processes 5. Awareness on Casting, Forging ,Welding Processes 6. Surface Finish on different

			<p>manufacturing processes</p> <p><b>7. Cutting parameters like speeds, feeds etc.</b></p>
<p>Professional Skill:60 Hours</p> <p>Professional Knowledge:20 Hours</p>	<p>Demonstrate reading and drawing of Engineering drawing.</p>	<p><b>3. Reading of Engineering Drawing:</b></p> <ol style="list-style-type: none"> <li>Types of projections, views (Orthographic view, Isometric view)</li> <li>Surface finishes, Geometrical symbols and accuracy</li> <li>Knowledge about Limits, fits &amp; Tolerance</li> <li>Conventional symbols</li> <li>Exercises on Engineering drawings</li> <li>Exercises on Conventional symbols drawings</li> </ol>	<p><b>Reading of Engineering Drawing:</b></p> <ol style="list-style-type: none"> <li>Types of Lines being used in Engineering drawing</li> <li>Various types of sheet layouts</li> <li>Selection of Scales</li> <li>Types of dimension lines</li> <li>Types of projections, views (Orthographic view, Isometric view)</li> <li>Surface finishes, Geometrical symbols and accuracy</li> <li>Knowledge about Limits, fits, Tolerance</li> <li>Conventional symbols</li> <li>Materials and Heat treatment</li> </ol>
<p>Professional Skill: 30 Hrs.</p> <p>Professional Knowledge: 10 Hrs.</p>	<p>Check accuracy of component with appropriate measuring instruments and prepare reports.</p>	<p><b>4. Basic Metrology:</b></p> <ol style="list-style-type: none"> <li>Use of different measuring instruments such as vernier calliper, Micrometer, Dial Gauges, Dial Indicators, Bevel Protractor, Height Gauge, GO/ No GO Gauges, Sine bar and Slip Gauges.</li> <li>To calculate different types of Deviations, Limits, Allowances, Tolerances, Grades and Fits.</li> </ol>	<p><b>Basic Metrology:</b></p> <ol style="list-style-type: none"> <li>Elements of inter-changeability system. Types of fits. Limit Gauges. Maximum Material Condition, Minimum Material Condition. Taylor's Principle.</li> <li>Measuring units in SI system, Calculations of Least Counts and principles of various measuring instruments.</li> <li>Calculations of errors, rectification and adjustment in various measuring instruments.</li> <li>Applications of different measuring instruments.</li> <li>Care and maintenance of measuring instruments.</li> </ol>
<p>Professional Skill:30</p>	<p>Demonstrate Heat treatment</p>	<p><b>5. Heat Treatment &amp; Material</b></p>	<p><b>Heat Treatment &amp; Material</b></p>

<p>Hours.</p> <p>Professional Knowledge: 10 Hours.</p>	<p>processes and perform testing of the materials</p>	<p><b>Testing:</b></p> <ol style="list-style-type: none"> <li>1. Demo on heat treatment and its operations</li> <li>2. Checking of Hardness</li> <li>3. Testing of Materials by tensile testing, impact testing, spectro analysis for chemical composition.</li> </ol>	<p><b>Testing:</b></p> <ol style="list-style-type: none"> <li>1. Study on various materials and testing methods.</li> <li>2. Study of Machinability and Hardenability of materials.</li> <li>3. Importance of heat treatment and operations</li> <li>4. Normalizing</li> <li>5. Annealing</li> <li>6. Hardening</li> <li>7. Case hardening</li> <li>8. Study of furnaces used for Heat Treatment.</li> </ol>
<p>Professional Skill:30Hours.</p> <p>Professional Knowledge: 10 Hours.</p>	<p>Select cutting tools for proper usage.</p>	<p><b>6. Cutting Tools &amp; Cutting Tool Parameters:</b></p> <ol style="list-style-type: none"> <li>1. Usage of cutting tools</li> <li>2. Usage of Cutting tool fluids/Coolants</li> <li>3. Practice of Cutting tool by :             <ol style="list-style-type: none"> <li>a)carbon alloys</li> <li>b) HSS</li> <li>c)Coated Inserts</li> <li>d) Diamond</li> <li>e) CBN (Carbon Boro Nitride)</li> </ol> </li> </ol>	<p><b>Cutting Tools &amp; Cutting Tool Parameters:</b></p> <ol style="list-style-type: none"> <li>1. Types of cutting tool</li> <li>2. Types of Tool Holders</li> <li>3. Cutting tool fluids/Coolants</li> <li>4. Knowledge of Cutting tool material             <ol style="list-style-type: none"> <li>a)carbon alloys b) HSS</li> <li>C) Cemented carbide d) Coated carbide e) Diamond f) CBN</li> </ol> </li> <li>5. Cutting tool geometry</li> <li>6. Selection of cutting tools based on work piece material</li> </ol>
<p>Professional Skill: 150 Hours.</p> <p>Professional Knowledge: 50 Hours.</p>	<p>Perform various types of drilling operations.</p>	<p><b>7. Conventional Machining:</b></p> <p><b>A) <u>Drilling Machines</u></b></p> <ol style="list-style-type: none"> <li>1. Perform and practicing Drilling operations</li> <li>2. Selection of appropriate tooling based on work job.</li> </ol> <p>(20 Hours)</p>	<p><b>Conventional Machining:</b></p> <p><b>A) <u>Drilling machines</u></b></p> <ol style="list-style-type: none"> <li>1. Study of Drilling machine construction.</li> <li>2. Study of accessories, Jigs and Fixtures, different types chuck, cutting tools and tool holders.</li> <li>3. To Study operations such as counter boring, counter sinking, tapping etc.,</li> <li>4. Selection of cutting speed, feed and depth of cut.</li> </ol>

			(10 Hours)
	Perform various types of milling operations.	<p><b><u>B) Milling Machines</u></b></p> <ol style="list-style-type: none"> <li>1. Perform and practicing of up &amp; down milling, face milling end milling</li> <li>2. selection of appropriate tooling based on work and type of milling</li> </ol> <p>(45 Hours)</p>	<p><b><u>B) Milling Machines</u></b></p> <ol style="list-style-type: none"> <li>1. Study of Milling machine construction and different types of milling machines</li> <li>2. Study of accessories, Jigs and Fixtures, different types of cutting tools and tool holders, clamping arrangements of job and attachments of milling machines</li> <li>3. Study of up milling down milling.</li> <li>4. Selection of cutting speed, feed and depth of cut. (15 Hours)</li> </ol>
	Perform various types of turning operations.	<p><b><u>C) Turning Machines</u></b></p> <ol style="list-style-type: none"> <li>1. Perform and practicing of all turning operations.</li> <li>2. selection of appropriate tooling based on work piece.</li> </ol> <p>(45 Hours)</p>	<p><b><u>C)Turning machines</u></b></p> <ol style="list-style-type: none"> <li>1. Study of Turning machine construction and various types of Turning machines</li> <li>2. Study of turning operations like facing, turning, taper turning, threading, drilling and boring.</li> <li>3. Selection of cutting speed, feed and depth of cut.</li> <li>4. Study of 3jaw chuck,4 jaw chuck, study rest, centres etc.</li> </ol> <p>(15 Hours)</p>

	Perform various types of grinding operations.	<p><b>D) <u>Grinding Machine</u></b></p> <ol style="list-style-type: none"> <li>1. Perform and practicing of various types of Grinding machines</li> <li>2. Selection of appropriate Grinding wheels.</li> </ol> <p>(40 Hours)</p>	<p><b>D) <u>Grinding machine</u></b></p> <ol style="list-style-type: none"> <li>1. Study of Grinding machine construction and various types of Grinding operations</li> <li>2. Study of Grinding operations like surface Grinding, Internal Grinding, Centreless Grinding, Jig Grinding etc.,</li> <li>3. Wheel speed, Work speed, through feed and in feed.</li> <li>4. Truing, Dressing and Wheel Balancing.</li> </ol> <p>(10 Hours)</p>
Professional Skill:60 Hrs.  Professional Knowledge:20 Hrs.	Prepare Process plan and sequence of operations.	<p><b>8. Process Planning:</b></p> <ol style="list-style-type: none"> <li>1. To understand the drawing</li> <li>2. To identify the sequences of operations</li> <li>3. Proper selection of cutting tools and work holding devices /Fixtures</li> <li>4. To prepare the process sheets for components</li> </ol>	<p><b>Process Planning:</b></p> <ol style="list-style-type: none"> <li>1. Importance of process planning</li> <li>2. Understanding the process planning parameters</li> <li>3. Understanding the sequences of operation along with machines, tools, work holding devices/ fixtures and measuring instruments required, setup time and operation time</li> </ol>
Professional Skills: 30 hrs.  Professional Knowledge: 20 hrs.	Make 2D Drawings in AutoCAD	<p><b>9. Auto CAD basics:</b></p> <ol style="list-style-type: none"> <li>1. Making of Sketch</li> <li>2. Dimensioning.</li> <li>3. Draw orthographic views.</li> <li>4. Working with Layers.</li> <li>5. Mesh &amp; Files in AutoCAD</li> <li>6. Making of Engineering Drawings.</li> <li>7. GD&amp;T Features.</li> <li>8. Creating Templates, Title blocks</li> <li>9. Plotting &amp; Publishing</li> <li>10. Project Work.</li> </ol>	<p><b>Auto CAD basics:</b></p> <ol style="list-style-type: none"> <li>1. Basic Orientation</li> <li>2. Importance of AutoCAD.</li> <li>3. Selection of commands.</li> <li>4. Learning of 2D drawings.</li> <li>5. Use of short cut Commands.</li> <li>6. Layers concept.</li> <li>7. File Formats.</li> <li>8. Project work.</li> </ol>

<p>Professional Skills: 60 hrs.</p> <p>Professional Knowledge: 20 hrs.</p>	<p>Create and analyze programs in Master CAM and post process to CNC machine.</p>	<p><b>10. Master CAM basics:</b></p> <ol style="list-style-type: none"> <li>1. Importance of 2D models</li> <li>2. Selection of tools for manufacturing.</li> <li>3. Methods of machining.</li> <li>4. Sequence of operations.</li> <li>5. Simulation</li> <li>6. Generation of Programme/Post processor (3- Axis)</li> <li>7. Sending program to the machining.</li> <li>8. Machining side Execute programme</li> <li>9. Write, enter, and Debug programs</li> <li>10. Project work</li> </ol>	<p><b>Master CAM basics:</b></p> <ol style="list-style-type: none"> <li>1. Importance of Master CAM.</li> <li>2. Introduction of 2D Sketch.</li> <li>3. Manufacturing machining selection (3 Axis)</li> <li>4. Tool selection.</li> <li>5. Tool path movements.</li> <li>6. Selection of Speed, Feed, Depth of cut, Work Offsets &amp; Tool offsets.</li> <li>7. Manufacturing procedure.</li> <li>8. Guidance on project work.</li> </ol>
<p>Professional Skill:90 hrs.</p> <p>Professional Knowledge: 20 hrs.</p>	<p>Understand the elements of CNC Machine.</p>	<p><b>11. CNC Programming 3-Axis:</b></p> <ol style="list-style-type: none"> <li>1. Demo of various types of CNC machines Ex: Turning center, turn-mill center (Horizontal &amp; Vertical), machining center (Horizontal and vertical machine)</li> <li>2. Demonstration elements of CNC machine like operator control panel, different axes, spindle, ATC/Tool Turret in case of lathe, Hydraulic power pack, Central Lubrication system, Coolant and Chip disposal system, Counter balance of vertical axis etc.</li> <li>3. Demo of different operating modes Ex: Jog, MDI, MDA, Auto, INC, Hand wheel(MPG), Reference point, Diagnostics</li> </ol> <p>(20 Hours)</p>	<p><b>CNC Programming 3-Axis:</b></p> <ol style="list-style-type: none"> <li>1. Comparison between CNC and Conventional machine.</li> <li>2. Advantages of CNC</li> <li>3. CNC machine elements.</li> <li>4. CNC lay out.</li> <li>5. Axis identification</li> <li>6. Co-ordinate system ( Turning and milling)</li> <li>7. Different manufacturers of CNC machines and controls.</li> </ol> <p>(4Hours)</p>

	<p>Write basic programs and Execute the programs for different operations for turning center.</p>	<p><b>CNC Programming 3-Axis:</b></p> <p><b>For turning centre</b></p> <ol style="list-style-type: none"> <li>1. Practical demo on input of part program on simulator</li> <li>2. Simulation of part program on turning.</li> <li>3. Input of part program on machine.</li> <li>4. Simulation of part program on machine.</li> <li>5. Setting of Tool and work off-sets on the machine.</li> <li>6. Practice exercises. :</li> <li>7. Demo on canned cycles on simulators.</li> <li>8. Practice exercises covering stock removal, threading and grooving.</li> <li>9. Operation and familiarization on CNC turning centers.</li> <li>10. Executing the program in auto Single Block and auto continuous mode.</li> <li>11. Practice on CNC lathe for different operations of production / job work</li> </ol> <p>(35 Hours)</p>	<p><b>CNC Programming 3-Axis:</b></p> <p><b>For turning centre</b></p> <ol style="list-style-type: none"> <li>1. Part Program structure, Block formation and different functional Alphabets used in programming. Ex: N, S, T, etc,</li> <li>2. Preparatory and miscellaneous codes used in the CNC programming. (G and M codes).</li> <li>3. Explaining about work off-sets and Tool Off-sets.</li> <li>4. Writing of simple part program on turning.(Turning, Facing, step turning, Radius turning, Taper turning)</li> <li>5. Exercises on turning.</li> <li>6. ISO designation of CNC turning Tools.</li> <li>7. Latest trends of CNC turning tools.</li> <li>8. Program generation through contouring option.</li> <li>9. Tool Nose Radius Compensation (TNRC).</li> <li>10. Canned cycles for turning like: Stock removal, Grooving, Threading, ( For Sinumeric and Fanuc controls)</li> </ol> <p>(8 Hours)</p>
--	---------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------



	<p>Write basic programs and Execute the programs for different operations for Machining center.</p>	<p><b>CNC Programming 3-Axis:</b></p> <p><b>For machining center</b></p> <ol style="list-style-type: none"> <li>1. Practical demo on input of part program on simulator</li> <li>2. Simulation of part program on milling.</li> <li>3. Input of part program on machine.</li> <li>4. Simulation of part program on machine.</li> <li>5. Setting of Tool and work off-sets on the machine.</li> <li>6. Practice exercises.</li> <li>7. Demo on canned /fixed cycles on simulators.</li> <li>8. Practice exercises covering stock removal, milling, drilling, boring etc.</li> <li>9. Operation and familiarization on CNC Horizontal and vertical machining centers.</li> <li>10. Executing the program in auto Single Block and auto continuous mode.</li> <li>11. Practice on CNC machining centers for different operations of production / job work.</li> <li>12. Practice of contour program for different profiles on CNC simulation software.</li> </ol> <p>(35 Hours)</p>	<p><b>CNC Programming 3-Axis:</b></p> <p><b>For machining center</b></p> <ol style="list-style-type: none"> <li>1. Program structure, Block formation and different functional Alphabets used in programming. Ex: N, S, T, etc,</li> <li>2. Preparatory and miscellaneous codes used in the CNC programming.(G and M codes).</li> <li>3. Explaining about work off-sets and Tool Off-sets.</li> <li>4. Writing of simple program on milling.(Face milling, Edge milling, Slot milling(radial &amp; circumferential).</li> <li>5. ISO designation of CNC cutting Tools.</li> <li>6. Latest trends of CNC cutting tools.</li> <li>7. Program generation through contouring option.</li> <li>8. Cutter Radius (CRC) and Tool length Compensation.</li> <li>9. Canned /fixed cycles for milling like: Drilling, Boring, Pocket milling, profile milling, Hole pattern ( For Sinumeric and Fanuc controls)</li> <li>10. Concept of contour programming for different profiles</li> </ol> <p>(8 Hours)</p>
<p>Professional Skills: 90 hrs.</p> <p>Professional</p>	<p>Execute Project work on CNC Turning and Machining Centers.</p>	<p><b>12. CNC Operation &amp; Project Work:</b></p> <ol style="list-style-type: none"> <li>1. Continuous Practice on CNC Turning and Machining Centers.</li> <li>2. Writing of work diary by every individual.</li> </ol>	<p><b>CNC Operation &amp; Project Work:</b></p> <ol style="list-style-type: none"> <li>1. Guidance on project work.</li> <li>2. Understanding of different machines and control systems available in Industry.</li> </ol>

<p>Knowledge: 30 hrs.</p>		<ol style="list-style-type: none"> <li>3. Recording daily progress instantly in the diary.</li> <li>4. Individual to work on turning and milling machines.</li> <li>5. Project identification.</li> <li>6. Execution and completion of project work.</li> <li>7. Preparation of project work report along with inspection report.</li> <li>8. PPT presentation on Project.</li> <li>9. Evaluation of Project work.</li> </ol>	<ol style="list-style-type: none"> <li>3. Preparation of part programs for live/production jobs.</li> <li>4. Understanding probing. ( Tool Probe and Job probe)</li> </ol>
<p>Professional Skills: 30Hours</p> <p>Professional Knowledge: 10 Hours</p>	<p>Perform basic CNC Maintenance.</p>	<p><b>13. CNC Maintenance Concepts:</b></p> <ol style="list-style-type: none"> <li>1. Practice on routine maintenance.</li> <li>2. Periodic checking of lubrication.</li> <li>3. Hydraulic oil level.</li> <li>4. Hydraulic system pressure.</li> <li>5. Chuck Pressure.</li> <li>6. Clearing alarms.</li> <li>7. Setting of machine parameters,</li> </ol>	<p><b>CNC Maintenance Concepts:</b></p> <ol style="list-style-type: none"> <li>1. Normal procedure followed for maintenance of machine tool in the shop floor.</li> <li>2. Difference between breakdown and preventive maintenance, Its importance in productivity.</li> <li>3. Preventive Maintenance.</li> <li>4. Importance of centralized lubrication system.</li> <li>5. Hydraulics &amp; pneumatics system and their uses</li> <li>6. Different alarm messages and trouble shootings.</li> <li>7. Observation of abnormalities such as noise and over temperature of machine elements.</li> </ol>
<p><b>Examination</b></p>			

## 6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Exhibit different workshop safety measures and use PPE & First aid kit.	Demonstrate Basic injury prevention and use of basic first aid kit
	Demonstrate waste material disposal as per procedure.
	Exhibit use of Preventive measures for Electrical accidents
	Demonstrate use of Fire extinguishers
2. Demonstrate various types of manufacturing processes and achievable surface finish values.	Illustrate conventional Machining Processes: Turning, Milling, Drilling, Boring, Grinding
	Explain surface Finish on different manufacturing processes
	Explain cutting parameters like speeds, feeds etc.,
3. Demonstrate reading and drawing of engineering drawing.	Illustrate types of projections, views (Orthographic view, Isometric view)
	Explain surface finishes, geometrical symbols and accuracy
	Explain Limits, fits, Tolerance
	Draw Engineering drawings of an object as per dimension to a specified scale
4. Check accuracy of component with appropriate measuring instruments and prepare reports.	Demonstrate use of different measuring instruments such as vernier calliper, Micrometer, Dial Indicators, Bevel Protractor, Height Gauge, GO/ No GO Gauges, Sine bar and Slip Gauges, etc.
	Demonstrate rectification and adjustment in various measuring instruments.
	Measure component with appropriate measuring instruments and prepare reports
5. Demonstrate Heat treatment processes and perform testing of the materials	Explain different heat treatment processes
	Demonstrate checking of Hardness
	Demonstrate testing of Materials
6. Select cutting tools for proper usage.	Explain use of cutting tools
	Explain use of Cutting fluids/Coolants
	Explain cutting tool geometry
	Demonstrate selection of cutting tools based on work piece materials
7. Perform various types of drilling operations.	Study the drawing and mark the work as per the drawing
	Demonstrate selection of appropriate tooling based on work.
	Perform appropriate operations as per the drawing

	Check the dimensions
8. Perform various types of milling operations.	Study the drawing and Prepare the work for desired operation
	Demonstrate selection of appropriate tooling based on work and operations.
	Perform milling operations as per the drawing
	Check the dimensions
9. Perform various types of turning operations.	Study the drawing and prepare the work for desired operation
	Demonstrate selection of appropriate tooling based on work and operations.
	Perform turning operations as per the drawing
	Check the dimensions
10. Perform various types of grinding operations.	Study the drawing and prepare the work for desired operation
	Demonstrate selection of appropriate tooling based on work and operations.
	Perform grinding operations as per the drawing
	Check the dimensions
11. Prepare Process plan and sequence of operations.	Study the drawing
	Plan for the desired sequences of operations
	Plan for required cutting tools and work holding devices /Fixtures
	prepare the process sheets for operations on the components as per the drawing
12. Make 2D Drawings in AutoCAD	Study the component and make sketch with dimension
	Draw orthographic views with Layers , Mesh & Files in AutoCAD
	Plot & Publish the drawing with GD&T Features, Templates and Title blocks.
13. Create and analyze programs in Master CAM and post process to CNC machine.	Study the drawing and ascertain methods of machining
	Select tools for manufacturing and prepare Sequence of operations
	Generate Programme/Post processor (3- Axis) and Simulate it
	Write, enter, and Debug programs onto machine
14. Understand the elements of CNC Machine.	Illustrate various types of CNC machines
	Demonstrate elements of CNC machine
	Exhibit different operating modes
15. Write basic programs and execute the programs for different operations for turning center.	Study the drawing and write program on required turning operations
	Input program on machine and simulate program on machine
	Demonstrate setting of Tool and work off-sets on the machine.
	Execute the program on CNC lathe for different operations of production / job work
	Check the dimensions of produced component
16. Write basic programs and Execute the programs for	Study the drawing and write program on required operations for CNC machining centres

different operations for Machining center.	Input program on machine and simulate program on machine
	Demonstrate setting of Tool and work off-sets on the machine.
	Execute the program on CNC machining centres for different operations of production / job work
	Check the dimensions of produced component
17. Execute Project work on CNC Turning and Machining Centers.	Study project drawing and write program on required operations for CNC turn centers and machining centers.
	Input program on machine and demonstrate setting of Tool and work off-sets on the machine.
	Execute the program on CNC turn centers and machining centres for different operations to complete the project work
	Check the dimensions of produced component and assemble them as per project drawing.
	Prepare project work report
18. Perform basic CNC Maintenance.	Demonstrate routine maintenance and checking of lubrication.
	Demonstrate checking of Hydraulic oil level and Hydraulic system pressure.

## 7. ANNEXURE-I

LIST OF TOOLS & EQUIPMENT			
CNC MACHINIST 3-AXIS			
S No.	Name of the Tools and Equipment	Specification	Quantity
<b>A. TRAINEES TOOL KIT</b>			
1.	Screw drivers box	Standard Specification	3sets.
2.	Long nose plier	150mm.	5 nos.
3.	Combination plier	150mm.	5 nos.
4.	Adjustable spanner or side wrench		5 nos.
5.	Hack saw frame adjustable	250 - 300mm. with blades	5 nos.
6.	Flat file	200mm.	5 nos.
7.	File triangular	150 mm.	5 nos.
8.	Half round file	150 mm	5 nos.
9.	Square file	150 mm	5 nos.
10.	Ring spanner set	Standard specifications metric	2 sets
11.	Box spanner set	Standard specifications metric	2 sets
12.	Hammer cross pane	500 gms. With handle	5 nos.
13.	Hammer small	250gms. With handle	5 nos.
14.	Grease Gun	500ml	5 nos.
<b>B.SHOP OUTFIT &amp; MEASURING INSTRUMENTS</b>			
<b>(i) List of Tools &amp; Accessories</b>			
15.	Slip gauge box	M45 Specifications	2 nos.
16.	Vernier Caliper	0-300mm	5 nos.
17.	Micrometer	0-100mm	5 nos.
18.	Height Gauge	0-300mm	5 nos.
19.	Depth Gauge	0-300mm	5 nos.
20.	Bore Gauge	0-100mm	5 nos.

21.	Dial gauge Stand	Standard	5 nos.
22.	Magnetic Stand	Standard	5 nos.
23.	Dial Indicator	Least count 0.01mm, range upto 10mm	5 nos.
24.	Surface roughness tester	Standard specifications-portable	2 no.
25.	Hardness Tester	Standard specifications-portable	2 no.
26.	Vernier bevel protractor	Least count 5 min.	3 nos.
27.	Combination Set	Standard specification	3 Sets.
28.	Sine bar	250mm	2 Nos.
29.	Sine Centre	300mm	2 Nos.
30.	Gear tooth vernier calliper	150mm, Least count 0.02mm	2 Nos.
31.	V blocks, Parallel blocks	Standard specifications	10 Sets.
32.	Tool Pre setter	<p>Tool Pre setter Specifications:</p> <ul style="list-style-type: none"> <li>* Measuring dia. (X axis ) - Upto 320 mm</li> <li>* Measuring length (Z axis)- 400 mm ;</li> <li>* High grade Cast Iron Base&amp; Column ;</li> <li>* Spindle taper : ISO 40 ;</li> <li>* Spindle rotation on Ultra precision bearings</li> <li>* Movement on Linear Motion guides and with Ball screws ;</li> <li>* 2 Axis DRO with Linear encoder with Least count of X axis- 0.001mm and Z axis 0.005 mm and with memory of storing data of 100 tools ;</li> <li>* Tool edge detection by Projector and Dial Indicators of 0.001mm for X axis and 0.010 mm for Y axis ;</li> <li>* Pneumatic tool clamping.</li> <li>* Compare Master gauge for gauge plane calibration &amp; test mandrel for diameter setting.</li> </ul>	1 Set
<b>(ii) List of Equipments</b>			
33.	AUTOCAD	AUTOCAD-2020 or latest Education Version -2D.	20 Licence – Per Batch of 20 students.
34.	Master Cam – 3 Axis Machining	Master CAM 2020 or latest – 3Axis Machining - Education Version	20 Licence – Per Batch of

		(Manufacturing Module)	20 students.
35.	Work Stations	OS – Windows 10. With 64 bit professional. Processor: Intel/AMD 64 Bit Processor, 3.2 GHz, HDD: 500 GB RAM: 16 GB Graphics Card: NVIDIA QUADRO 4 GB Monitor – 21 Inch Mouse, Key Board. MS office	20 work stations Per batch of 20 students.  20 MS Office License
36.	Class Room Tables / Benches	Specifications As per requirement	20 Nos.
37.	Class Room Chairs	Specifications As per requirement	20 Nos.
38.	Instructor Table	Executive Table	1 No
39.	Instructor Chair	Executive Chair	1 no.
40.	Interactive board with accessories		1 no.
41.	<b>Internet Connection-FTTH</b>	100 mbps minimum	1 No.
42.	<b>Local Area Network (LAN) with 24 port Switch</b>	24 port LAN Switch, 4U Rack Wall mount and Cabling layout for 20 I/O ports, RJ-45 cables with connectors for 20 workstations.	1 LAN system
43.	LCD Projector with accessories		1 no.
44.	Uninterrupted Power Supply (UPS)	5KVA, 3 hours Backup time.	1 nos.
45.	Multi-Function Device (MFD) Printer	Printer Scanner Copier With Accessories	1 no.
46.	Computer Tables	As per requirement	20 nos.
47.	Computer Chairs	As per requirement	20 nos.
48.	White Board	1200mm x 900mm	1 no.
<b>GENERAL INSTALLAION AND MACHINERIES</b>			
49.	<b>Conventional Machines</b>		
	Lathe Machine	<ul style="list-style-type: none"> <li>• Height of centres 200mm</li> <li>• Swing over bed 420mm</li> <li>• Swing over cross slide 220mm</li> <li>• Distance between centres 1000mm</li> <li>• Spindle nose/bore A2-5 / 42mm</li> <li>• Spindle socket taper metric 50</li> </ul>	2 nos.



		<ul style="list-style-type: none"> <li>• Speed range 8 to 60 to 1500 rpm</li> <li>• Feed ranges : Longitudinal 24 from 0.05 – 2.8 mm/rev. Cross 24 from 0.01 to 0.62 mm/rev.</li> <li>• Metric threads 24 from 0.5 to 14 mm</li> <li>• Carriage Cross slide travel 215 mm</li> <li>• Carriage Top slide travel 105 mm</li> <li>• Tool shank size 25 x 25</li> <li>• Tailstock sleeve dia/taper 70/MT4</li> <li>• Trail stock Sleeve travel 140mm</li> <li>• Power of Main motor 3kW.</li> <li>• Standard tooling along with adopters 1 set.</li> <li>• Standard Accessories 1 set.</li> <li>• Tool and Work-holding devices -1 Set.</li> <li>• Standard Tools-1 Set.</li> </ul>	
	<p>Milling Machine</p>	<ul style="list-style-type: none"> <li>• Universal milling machine.</li> <li>• Clamping area 1350 x310 mm</li> <li>• Number / Width of T slots 3 /16mm</li> <li>• Power traverse – longitudinal/cross/ vertical 800 / 265 / 400.</li> <li>• Maximum load on Table 250 Kgs.</li> <li>• Swivel of Table: +/- 45 degrees.</li> <li>• Number of speed / speed range 18/35.5 – 1800 rpm.</li> <li>• Spindle nose ISO 40.</li> <li>• Lower face of milling spindle to table top 70/470.</li> <li>• Number of feeds 18.</li> <li>• Feed range - longitudinal &amp; cross 16 to 800mm/min. Vertical 4 to 200mm/min.</li> <li>• Rapid traverse- longitudinal &amp; cross 3200mm/min. Vertical 800mm/min.</li> <li>• Power – Main Motor 5.5 kW Feed motor 1.5 kW.</li> <li>• Standard tooling along with adopters 1</li> </ul>	<p>2 No.</p>

		<ul style="list-style-type: none"> <li>set.</li> <li>• Standard Accessories 1 set.</li> <li>• Tool and Work-holding devices -1 Set.</li> <li>• Standard Tools-1 Set.</li> </ul>	
	Drilling Machine	<ul style="list-style-type: none"> <li>• Drilling in steel (50Kgf/sq. Mm) 50mm.</li> <li>• Drilling in cast iron(BHN 180) 60 mm.</li> <li>• Tapping in steel-metric fine threads M56.</li> <li>• Taper in spindle MT5.</li> <li>• Number of spindle speeds /Speed range 12/40 – 1800 rpm.</li> <li>• Number of feeds /Feed range: 6/0.125 to 1.25 mm/rev.</li> <li>• Column Sleeve dia. 350mm.</li> <li>• Drilling radius maximum 1500mm.</li> <li>• Quill traverse 325mm.</li> <li>• Drilling head traverse 970 mm.</li> <li>• Arm traverse 740 mm.</li> <li>• Standard tooling along with adopters 1 set.</li> <li>• Standard Accessories 1 set.</li> <li>• Tool and Work-holding devices -1 Set.</li> <li>• Standard Tools-1 Set.</li> </ul>	<b>2 No.</b>
	Surface Grinding Machine	<ul style="list-style-type: none"> <li>• Work Area 600 x 300 mm.</li> <li>• Longitudinal Traverse 625mm.</li> <li>• Cross Traverse 325mm.</li> <li>• Table Longitudinal Speed 3 to 20 m/min.</li> <li>• Cross Feed per Stroke at each reversal 0 to 2.0 mm.</li> <li>• Vertical movement of wheel head 400mm.</li> <li>• Wheel speed 2800 rpm.</li> <li>• Wheel size 250 x 25 x76 mm.</li> <li>• Wheel heads motor 2.2 kW.</li> <li>• Standard tooling along with adopters 1 set.</li> <li>• Standard Accessories 1 set.</li> <li>• Tool and Work-holding devices -1 Set.</li> <li>• Standard Tools-1 Set.</li> </ul>	<b>2 No.</b>

50.	<b>CNC Machines (3-Axis)</b>		
	CNC Turning Centre	<ol style="list-style-type: none"> <li>1. Swing over bed: 430 mm.</li> <li>2. Max. Turning dia over cross slide 200mm.</li> <li>3. Max. Turning length with chuck: 410mm.</li> <li>4. Spindle nose A2-5.</li> <li>5. Bar passage /Spindle bore: 44mm</li> <li>6. Spindle power : 5.5kW</li> <li>7. Spindle Speeds: 30 to 3000 rpm.</li> <li>8. Spindle socket taper: metric 50.</li> <li>9. Feed Range (Long /Cross): 1 to 5000 mm/min.</li> <li>10. Rapid traverse (Long/Cross): 18000mm/min.</li> <li>11. Stroke (Long/Cross): 455/175 mm.</li> <li>12. No. Of tool stations (turret) 8/12.</li> <li>13. Tailstock travel: 70mm.</li> <li>14. Control System: Siemens / Fanuc.</li> <li>15. Positioning Accuracy/Repeatability as per VDI / DGQ 3441: 0.012 / 0.006 mm.</li> <li>16. Standard tooling along with adopters 1 set.</li> <li>17. Standard Accessories 1 set.</li> <li>18. Tool and Work-holding devices -1 Set.</li> <li>19. Standard Tools-1 Set.</li> </ol>	<b>1 No.</b>
	CNC Vertical Machining Centre	<ol style="list-style-type: none"> <li>1. Size of the Table: 600mm x 300 mm</li> <li>2. Max. Load on Table: 250 Kgf.</li> <li>3. x-axis stroke: 500mm</li> <li>4. y-axis stroke: 400 mm</li> <li>5. z-axis stroke: 500 mm</li> <li>6. Rapid traverse of Linear axis: 15 m/min.</li> <li>7. spindle taper: ISO 40 / BT 40</li> <li>8. Spindle power: 11kW</li> <li>9. Spindle speed: 1 to 6000 rpm</li> <li>10. Automatic Tool Changer (ATC): 20 tools</li> <li>11. Control System: Siemens / Fanuc or equivalent.</li> <li>20. Positioning Accuracy/Repeatability as per VDI / DGQ 3441: 0.012 / 0.006 mm.</li> <li>12. Standard tooling along with adopters 1</li> </ol>	<b>1 No.</b>

		<p>set.</p> <p>13. Standard Accessories 1 set.</p> <p>14. Tool and Work-holding devices -1 Set.</p> <p>15. Standard Tools-1 Set.</p>	
	CNC Horizontal Machining Centre	<p>1. Size of the Pallet: 400mm x 400 mm</p> <p>2. No. Of Pallets : 2.</p> <p>3. Max. Load on Table: 400 Kgs.</p> <p>4. X-axis stroke: 550mm.</p> <p>5. Y-axis stroke: 600 mm.</p> <p>6. Z-axis stroke: 550 mm.</p> <p>7. Rapid traverse of Linear Axis: 15 m/min.</p> <p>8. Spindle taper: ISO 40 / BT 40.</p> <p>9. Spindle power: 11kW.</p> <p>10. Spindle speed: 1 to 6000 rpm.</p> <p>11. Automatic Tool Changer (ATC): 20 tools</p> <p>12. Control System: Siemens / Fanuc or equivalent.</p> <p>21. Positioning Accuracy/Repeatability as per VDI / DGQ 3441 For Linear Axes: 0.012 / 0.006 mm.</p> <p>For Rotary Axes: 20/10 arc-secs.</p> <p>13. Standard tooling along with adopters 1 set.</p> <p>14. Standard Accessories 1 set.</p> <p>15. Tool and Work-holding devices -1 Set.</p> <p>16. Standard Tools-1 Set.</p>	<b>1 No.</b>
<b>SHOP FLOOR FURNITURE AND MATERIALS</b>			
51.	Work Bench Tables with Vice	Standard Size	20 Nos.
52.	Raw Material for jobs	AS per Raw materials standard specifications	As required
53.	Fire Extinguishers	2Kg CO2 / Powder 5 Kg CO2 / Powder	As required
54.	First Aid Kit with Accessories	HE*Gloves, w/o powder, nitr, M, disp, box/100-1 no. Tape, adhesive, Z.O., 2.5cmx5m -2 nos. Tape adhesive, Z.O, perforated, 10cmx5m – 1 no. Bandage, elastic, 7.5cmx5m, roll -2 nos.	As required

		<p>Bandage, gauze, 8cmx4m, roll -10 nos.</p> <p>First Aid bag, UNICEF, blue, 410x280x170mm -1 no.</p> <p>Compress, gauze, 10x10cm, n/ster/PAC-100 -1 no.</p> <p>Compress, paraffin, 10x10cm, ster/BOX-10 -1 no.</p> <p>Compress, gauze, 10x10cm, ster/PAC-5 -10 nos.</p> <p>Pin, safety, medium size/PAC-12 -1 no.</p> <p>Soap, toilet, bar, approx.110g, wrapped -1 no.</p> <p>Blanket, survival, 220x140cm -1 no.</p> <p>Towel, huck, 430 x 500mm -1 no.</p> <p>Forceps, dressing, standard, 155mm, str-1 no.</p> <p>Forceps, artery, Kocher, 140mm, str -1 no.</p> <p>Scalpel blade, ster, disp, no. 22 -1 no.</p> <p>Scissors, Deaver, 140mm, str, s/b -1 no.</p> <p>Ibuprofen 200mg tabs/PAC-100 m-1 no.</p> <p>Tetracycline eye ointment 1%/TBE-5g -1 no.</p> <p>Chlorhexidine conc. sol. 5%/BOT-100ml -1 no.</p>	
55.	PPE Kit	All Protective equipments with accessories	As required

## 8. ANNEXURE-II

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts and all others who contributed in designing/ revising the curriculum. Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

<b>List of Industry Expert Members contributed/ participated for finalizing the course curriculum of CNC MACHINIST 3-AXIS.</b>			
<b>S No.</b>	<b>Name &amp; Designation Shri/Mr./Ms</b>	<b>Organization</b>	<b>Remarks</b>
1.	Sh. A. V. Rao, Regional Director	RDSDE, Telangana	Convenor
2.	Dr. G. Sridhar, Chief Manager- Manufacturing	HAL, Hyderabad	Member
3.	Sh. M. Masaiah, JWM(SG)	Ordnance Factory, Medak	Member
4.	Sh. T N Murthy, JWM(SG)	Ordnance Factory, Medak	Member
5.	Sh. N. Venkateshwar, DE-1	Bharat Dynamic Limited, Hyderabad.	Member
6.	Sh. BVSS Prasad, General Technical Manager (retd)	HMT, Hyderabad	Member
7.	Sh. Deva Dass, Managar (Retd)	HMT, Hyderabad	Member
8.	Sh. MM Baig, JWM (Retd)	Ordnance Factory, Medak	Member
9.	Dr. Manohar, Faculty	Subject Expert	Member
10.	Sh. CH SambasivaRao, JWM (Retd)	Ordnance Factory, Medak	Member
11.	Sh. B. Pramod, Manager	Design Tech, Hyderabad	Member
12.	Sh. Lakshmi Narayana, Asst. Manager	EDS Systems, Hyderabad	Member
13.	Sh. Mahesh Reddy, Faculty	Ex- CITD, Hyderabad	Member
14.	GP Vijaya Krishna, Asst. Director	NSTI(V), Hyderabad	Member
15.	Sh. Murali Krishna, Training Officer	NSTI (V), Hyderabad	Member
16.	Sh. BS Reddy, Training Officer	NSTI(V), Hyderabad	Member
17.	Sh. BanniBagi, Asst. Director	NSTI(R), Hyderabad	Member

List of STCC Members			
SNo.	Name & Designation Sh/Mr./Ms.	Organization	Remarks
18.	A VENKATESWARA RAO, DIRECTOR	RDSDE, Hyderabad, Telangana	Member
19.	S. V. K. NAGESH, JOINT DIRECTOR	DET, Hyderabad, Telangana	Member
20.	N. SRINIVASA RAO,, PRINICIPAL	GOVT. ITI, Pathanchervu, Hyderabad	Member
21.	K. B. S. NARAYANA, TRAINING OFFICER	CSTARI, Kolakota	Member
22.	S. GOPALAKRISHNA, ASSISTANT MANAGER	NIMI, Chennai	Member
23.	Ms. SHALINI SINGH, COO,	NSDC, New Delhi.	Member
24.	1. Dr. MRM Babu, Director, Distinguished Scientist. 2. BVSS Prasad, General Technical Manager. 3. A. Purushottam, Scientist F, 4. Shri. DevendraBhardwaj, Deputy Gen, Manager, Production & Procurement. 5. Shri. Ravindra Reddy, Addl. Gen. Manager-Manufacturing. 6. Dr. G. Sridhar, Chief Manager Methods. 7. Shri. W. NarasimhaRao, DGM-MS 8. Shri. M. Mruthayumjayudu, Senior DGM (Corporate Learning Development Centre)	1. ASL-DRDO, Hyderabad. 2. HMT, Hyderabad 3. ASL-DRDO, Hyderabad. 4. Ordnance Factory Medak 5. Bharat Dynamics Limited, Hyderabad 6. Hindustan Aeronautics Limited, Hyderabad. 7. BEL, HYDERABAD 8. Electronics Corporation of India Limited(ECIL), Hyderabad	Member
25.	1. K. MAHENDAR, Deputy Director. 2. A. A. MAHISHI, Deputy Director 3. G P. VIJAYAKRISHNA,Asst. Director	NSTI, BENGALURU NSTI (V), HYDERABAD NSTI (V), HYDERABAD	Member
26.	N. P. BANNIBAGI, Asst. Director.	NSTI-R, HYDERABAD.	Member

VETTING EXPERTS - CNC MACHINIST 3-Axis

Sl. No.	Name & Designation Sh/Mr./Ms.	Organization	Remarks
1	Dr. MRM Babu, Director, Distinguished Scientist	ASL-DRDO Hyderabad	
2	Dr. V. Venkateswara Rao, Director	ARDE-DRDO Pune	
3	Sh. Ramachandran, DDG	Ordnance factory Board New Delhi	
4	Sh. S Sahadev, General Manager (Retd.)	Ordnance Factory, Jabalpur	
5	Sh. Shivapal Singh, Project Director	DRDL-DRDO Hyderabad	
6	Sh. Shiva Dayal B., Scientist -G, Group Director Engineering	DRDL-DRDO Hyderabad	
7	Sh. Kiran Polamuri, Scientist G, Technology Director, Engineering	DRDL-DRDO Hyderabad	
8	Sh. Murty T. S., Retd. Principal Director	OFIL, HVF Avadi, Chennai	
9	Sh. Suryanarayana, AGM - Engineering Services (Retd.)	MIDHANI, Hyderabad	
10	Sh. Srinivas Rao , AGM	Ordnance factory, Medak	
11	Sh. Veeraraj, AGM-QA	HVF Avadi Chennai	
12	Sh. Sanjay Dwivedi, AGM	Ordnance factory Board New Delhi	
13	Sh. V. Ravinder, AGM(Mfg)	Bharat Dynamics Limited, Kanchanbagh	
14	Commodore M. L. Narayana, Scientist F, Director Management Services	DRDL-DRDO, Hyderabad	
15	Dr. Mastanaiah. P., Scientist -F	DRDL-DRDO, Hyderabad	
16	Sh. Mandal, Scientist-F	DRDL-DRDO, Hyderabad	
17	Sh. Purushottam, Scientist F.	ASL-DRDO, Hyderabad	
18	Sh. Chandresh Khonde, DGM (HT & EP)	Bharat Dynamics Limited, Bhanur	
19	Sh. R. V. B. Nageswara Rao, DGM (QC-IG &MTL)	Bharat Dynamics Limited, Bhanur	
20	Sh. Devendra Singh Bhardwaj, DGM	Ordnance Factory, Medak	
21	Sh. Mruthumjayaudu, DGM, Corporate Learning & Development	Electronics Corporation of India Limited, Hyderabad	
22	Sh. Sridhar , DGM	Bharat Dynamics Limited, Hyderabad	
23	Sh. Vinodan, DGM (Retd)	Hindustan Machine Tools Hyderabad	
24	Sh. Atul Singh, DGM Retd.	BHEL, Hyderabad	
25	Sh. Narasimha Rao W ,. DGM	Bharat Electronics Limited Hyderabad	
26	Sh. B V S S Prasad, General Technical Manager	Hindustan Machine Tools Hyderabad	



27	Dr. G. Sridhar Chief Manager	Hindustan Aeronautics Limited Hyderabad	
28	Sh. Harish B, Vice President	Ace Micromatic Group Bengaluru	
29	Sh. Praveen Kumar, DM - Appr.	Bharat Dynamics Limited	
30	Sh. Ankalu, Retd Technical Officer-D	DMRL-DRDO Hyderabad	
31	Dr. Srinivas Rao P, Senior Manager Tech Training/ Learning & Development	Cyient Hyderabad	
32	Sh. Srinivasan K, Manager	DMG Mori	
33	Sh. Seshu, Consultant, Ex- Kirloskar Company	Kirloskar Bengaluru	
34	Sh. Pusparaj Satpathy, Vice President-HR	MTAR Technologies Pvt. Limited, Hyderabad	
35	Sh. G. K. C. Kumar, DGM - Manufacturing	SEC Industries Private Limited, Hyderabad	
36	Sh. Shankar Narayanan, Chief Manager, CNC Training & Development	Siemens Limited, Bangalore	
37	Sh. AV Rao, CEO	Madhu Babu Industries Pvt Ltd, Hyderabad	
38	Sh. Ramesh Krishna, CEO	Ramesh Krishna Engineers Pvt. Ltd.	
39	Sh. Ranga Raju, CEO	Vem Technologies Pvt Ltd, Hyderabad	
40	Sh. M Siva Rama Prasad, CEO	Tech Aero Devices, Hyderabad	
41	Komara Srinivasu, DGM Tooling (retd)	LCA Tejas Division, HAL Bangalore	
42	Thamizharasan, Retd (Director)	NSTI, Kolkota	