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

COMPETENCY BASED CURRICULUM
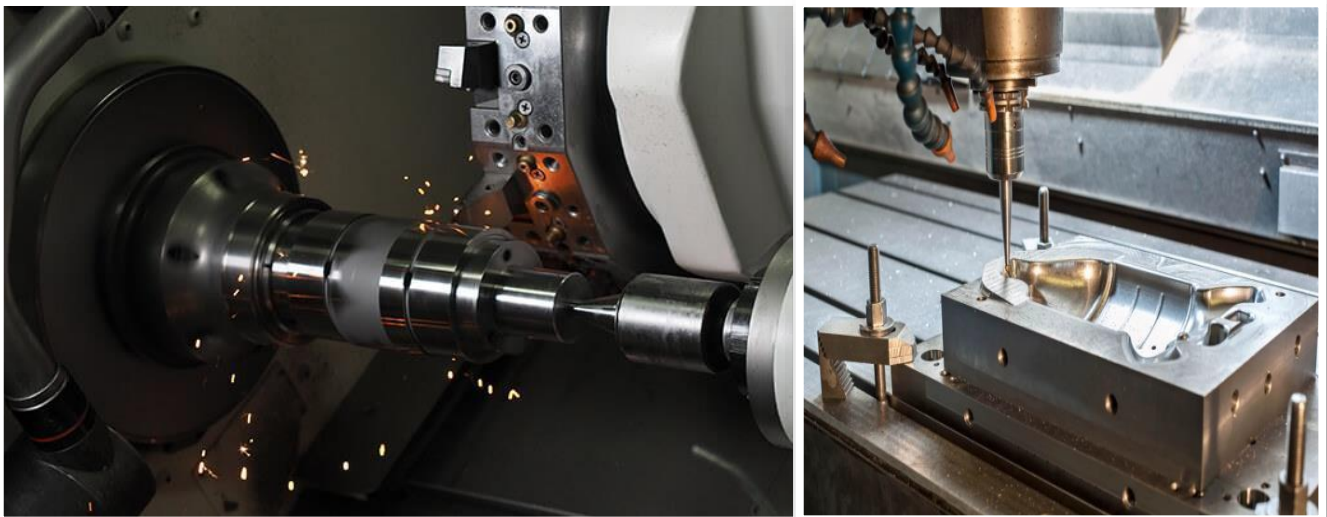
ADVANCED CNC MACHINING TECHNICIAN

(Duration: Two Years)
Revised in July 2022
CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 4

SECTOR – CAPITAL GOODS AND MANUFACTURING

ADVANCED CNC MACHINING TECHNICIAN

(Engineering Trade)

(Revised in July 2022)

Version: 2.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL - 4

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CONTENTS

S No.	Topics	Page No.
1.	Course Information	1
2.	Training System	2
3.	Job Role	6
4.	General Information	9
5.	Learning Outcome	11
6.	Assessment Criteria	13
7.	Trade Syllabus	19
8.	Annexure I (List of Trade Tools & Equipment)	38

1. COURSE INFORMATION

During the duration of this course, the students are imparted the knowledge on CNC Machining and employability skills related to the job role and trained on Skills related to CNC Machining. The students shall undertake live projects and are expected to engage in extracurricular activities so that his morale and confidence is built up. Practical skills are imparted on the Advanced CNC Machines and the theory related to this subject is taught in a way that the students are able to use their cognitive skills and use it while executing the task assigned to them.

The course is designed in such a way that the students can program and operate any Advanced CNC Turning Center, Vertical Machining Center with ATC and fourth axis. The students are given basic knowledge of TPM, and preventive maintenance. The students shall be able to perform self-inspection of the components made by them. The broad components covered under Professional Skill subject are as below:-

FIRST YEAR: Safety being the most important thing in all the industries now a day is covered in the first year to start with. The input in this trade is always the drawing, so the students are taught to read Industrial drawings, concept of GD & T and ISO Tolerances. The students are also introduced to latest trends and other advanced technologies. The students are oriented with the computer aided machining concept and given working knowledge of types of cutting tools & selection criteria. The students are also imparted the knowledge of materials used in industry and their properties & their impact on cutting tool life. The students are trained in use of different measuring instruments used in the industry and selection of appropriate measuring instrument based on the tolerance as per component drawing.

The practical training starts with the standard operating practices of the CNC Machines based on the operating manual like referencing, checking the condition of tools, spindle orientation, checking the daily check points etc. The students are taught the basic G-codes and M-codes used for programing the CNC Turning Center, making of program and running it in various modes and optimizing the program for idle movement for cycle time.

SECOND YEAR: In the second year, the students are taught the operation and programing of Vertical Machining Center with ATC and 4th axis.

The practical training starts with the standard operating practices of the VMC based on the operating manual like referencing, checking the condition of tools, spindle orientation, checking the daily check points etc. The students are taught the basic G-codes and M-codes used for programing the Vertical Machining Center, making of program and running it in various modes and optimizing the program for idle movement for cycle time.Alsooperatingandprogrammingof4&5axis machine, tool indexing, program creation & simulation. Preventive maintenance of machines & basic trouble shooting practices.

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of Labor market. The vocational training programs are running under aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) with variants and Apprenticeship Training Scheme (ATS) are two pioneer programs under DGT for propagating vocational training.

Advanced CNC Machining Technician trade under CTS is delivered nationwide through a network of ITIs. The course is of two years' duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory & Practical) imparts professional skills and knowledge, while Core area (Employability Skills) imparts requisite core skill & knowledge and life skills. After passing out of the training program, the trainee is awarded National Trade Certificate (NTC) by DGT which is recognized worldwide.

Trainee broadly needs to demonstrate that they are able to:
- Read & interpret technical parameters/documentation, plan and organize work processes, identify necessary materials and tools;
- Performtaskwithdueconsiderationtosafetyrules,accidentpreventionregulationsand environmental protection stipulations;
- Apply professional knowledge, core skills & employability skills while performing the job and maintenance work.
- Self-certify the task / job with appropriate measuring tools depending on the tolerances / quality plan.
- Check the task/job for functioning, identify and rectify errors in task/job.
- Document the technical parameters related to the task undertaken.

2.2 PROGRESSION PATHWAYS
- Can join industry as CNC Machining Technician and will progress further as Senior Technician, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- Can take admission in diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship program in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Can join Advanced Diploma (Vocational) courses under DGT as applicable.

2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of two years:

S No.	Course Element	Notional Training Hours	
		1st Year	2nd Year
1	Professional Skill (Trade Practical)	840	840
2	Professional Knowledge (Trade Theory)	240	300
5	Employability Skills	120	60
	Total	**1200**	**1200**

Every year 150 hours of mandatory OJT (On the Job Training) at nearby industry, wherever not available then group project is mandatory.

On the Job Training (OJT)/ Group Project	150	150

Trainees of one-year or two-year trade can also opt for optional courses of up to 240 hours in each year for 10th/ 12th class certificate along with ITI certification or add on short term courses.

2.4 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 program 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. The marks of internal assessment will be as per the formative assessment template provided onwww.bharatskills.gov.in.

b) The final assessment will be in the form of summative assessment. The All India Trade Test for awarding NTC will be conducted by Controller of examinations, DGT as per the guidelines. 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. The examiner during final examination will also check** the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six

months and one-year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percent for Trade Practical and Formative assessment is 60% & for all other subjects is 33%.

2.4.2 ASSESSMENTGUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking the assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising some of the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work
- Computer based multiple choice question examination
- Practical Examination

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming examination for audit and verification by examining body. The following marking pattern to be adopted for formative assessment:

Performance Level	Evidence
(a) Marks in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracy achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.

(b) Marks in the range of 75%-90% to be allotted during assessment	
Forth is grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish. • Little support in completing the project/job.
(c) Marks in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

Advanced CNC Machining Technician Course deals with Advanced Computer operated Machines like Vertical Machining Center, Turning Center to mass produce components with very high precision and repeatability and minimizing the rejection rates to a minimum level. The basic knowledge of workshop practices is harnessed with additional knowledge of CNC. Advanced CNC Machining Technician can read the industrial drawing and notes. As a senior technician he can decide the manufacturing Process, sequence of operations, number of set up, tooling selection and programming. As a senior technician, he can confirm and perform the feasibility study for new product development & support in calculate machining cost. A senior superior sets up, program and adjusts CNC & VMC machines with optimum feed, speed & depth of cut to increasing productivity. Understanding of parameters for machines and their effectonmanufacturingcycletimeandprovidingsupporttoeachmachinist working under his guidance. He can also coordinate and manage manufacturing processes in plant. Develop budgets for machine shop and estimating up gradation costs for various processes. Keeping record of the operations of CNC Machines like cost of tools, cost of poor quality, cost of coolant, chips generation and their disposal. Also simulating machining path of VMC & Turning Centre & calculate machining cycle time and sets control parameters to regulate machines.

Plan and organize work, detect & resolve issues during operations. Assign work to junior technicians and set goals. Manage team and be sensitive to the environment, and be amenable for self-development.

Perform TPM (Total Productive Maintenance), TQM (Total Quality Management) and record keeping as per ISO requirement.

Machining Technician; is also known as Machinist or CNC Machine Operator. The role covers operations of different machine tools performed both-manually and through automatic/CNC machines/ robots. This role primarily involves all kinds of machining and in-line inspection activities for quality verification, ad hoc repair work, change of worn out parts, gauging and deburring activities.

CNC Operator-Machining Technician; sets up base level operations of different machine tools and same can be performed both manually and through automatic machines/robots. Machining Technician Level 3 is often called Assistant Machinist, Junior Machinist, Lathe Operator, Apprentice Machinist, Semi- Skilled Operator. This role primarily involves supporting the Machine Operator in all pre machining activities, machining of the actual part, ad hoc repair work like in auto service stations, gauging, and deburring and inspection activities.

CNC Operator; is responsible for maintaining and operating CNC machine. The individual monitors gauges and dials. The individual must be proficient in programming and setting CNC machinery.

CNC Operator-Vertical Machining Centre; produces components that combine a number of different features, such as flat faces, parallel faces, faces square to each other, faces at an angle, steps/shoulders, open and enclosed slots, drilled, bored and reamed holes, internal threads, and special forms. It involves continuously monitoring, inspecting the components and meeting production targets.

CNC Setter cum Operator-Turning; sets up the CNC turning machine, its work holding devices, tooling, loading the machine operating programs, conducting trial runs and correcting faults, in order to ensure that the work output is produced as per specification.

CNC Operator-Turning; removes metal from the outer diameter of a rotating cylindrical work piece. It also involves inspecting the components and continuously monitoring of the machining operations and making minor adjustments in order to ensure that the work output is to the required quality and accuracy.

CNC Programmer; produce the component program using manual data input or by use of a remote computer, saving the prepared program on the machine controller from the computer. This involves understanding the CNC machine tools used in the process, their application and programming, editing and proving process, in adequate depth to provide a sound basis for carrying out the activities.

Metal Machine Tool Setter and Operators, Other includes; all other Machine Tool Operators engaged in operating automatic, semi-automatic and simple special purpose production machines, sawing and filing by machine, grinding by hand, cutting threads in bolts and nuts etc., and may be designated as; Automatic Machine Operator if tends and feed, one or more automatic machine tools; De-Burrer if removes burrs and rough spots from metal parts or castings by use of hand files or using emery stone; Sawing Machine Operator if cuts and files various materials using electrically powered band-type sawing and filing machines; Thread Roller if tends screw making machine in which thread is formed on screws by rolling head with circular dies by action of hardened metal dies that reciprocate, rolling screw shank between their surfaces and pressing metal of screw shank into thread form; Tapping Machine Operator if cuts internal and external threads by means of tapping machine set up and adjusted by other workers or themselves; Profile Roller etc.

Machine Shop Supervisor; role covers supervision of operations for different machine tools performed both manually and through automatic/CNC machines/robots. This role primarily involves supervising all kinds of machining and in-line inspection activities for quality verification, resolving line operation issues, review of fixtures etc.

Reference NCO-2015:

   a) 7223.5001 – Machining Technician/CNC Operator

   b) 7223.5002 – CNC Operator – Machining Technician

   c) 7223.5003 – CNC Operator – Machinist

   d) 7223.5004 – CNC Operator - Vertical Machining Centre

   e) 7223.6001 – CNC Setter-cum-Operator – Turning

   f) 7223.6002 – CNC Operator – Turning

   g) 7223.6003 – CNC Programmer

   h) 7223.9900 – Metal Working Machine Tool Setters and Operators, Others

   i) 7223.0502 – Machine Shop Supervisor

Reference NOS: --

   i.   CSC/N1335

   ii.   CSC/N0116

   iii. CSC/N0115

   iv.   CSC/N9408

   v.   CSC/N9401

   vi.   CSC/N0120

   vii. CSC/N0123

   viii. CSC/N9402

   ix.   ISC/N9416

   x.   ISC/N9417

   xi.   ISC/N9418

   xii. ISC/N9419

Name of the Trade	ADVANCED CNC MACHINING TECHNICIAN
Trade Code	DGT/2027
NCO - 2015	7223.5001, 7223.5002, 7223.5003, 7223.5004, 7223.6001, 7223.6002, 7223.6003, 7223.9900, 7223.0502.
NOS Covered	CSC/N1335,CSC/N0116,CSC/N0115 ,CSC/N9408, CSC/N9401,CSC/N0120 ,CSC/N0123 ,CSC/N9402 ,ISC/N9416,ISC/N9417 ,SC/N9418 ,ISC/N9419
NSQF Level	Level – 4
Duration of Craftsmen Training	Two years (2400 hours + 300 hours OJT/Group Project)
Entry Qualification	Passed 10th class examination
Minimum Age	14 years as on first day of academic session.
Eligibility for PwD	LD, CP, LC, DW, AA, BLIND, LV, DEAF, HH, AUTISM, ID, SLD
Unit Strength (No. Of Student)	24 (There is no separate provision of supernumerary seats)
Space Norms	192 Sq.
Power Norms	17 KW
Instructors Qualification for	
1. Advanced CNC Machining Technician Trade	B. Voc/Degree in Mechanical Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.
	OR
	03 years Diploma in Mechanical Engineering from AICTE recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field.
	OR
	NTC/NAC passed in the Trade of "ADVANCED CNC MACHINING" With three years' experience in the relevant field.
	<u>Essential Qualification:</u>
	Relevant Regular/RPL variants of National Craft Instructor Certificate (NCIC) under DGT.
	Note: Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications. However, both of them must possess NCIC in any of its variants.

2. Workshop Calculation & Science	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.
	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.
	OR
	NTC/ NAC in any one of the engineering trades with three years' experience.
	Essential Qualification:
	Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade
	OR
	Regular / RPL variants NCIC in RoDA or any of its variants under DGT
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/UGC recognized Engineering College/ university with one-year experience in the relevant field.
	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.
	OR
	NTC/ NAC in any one of the Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience.
	Essential Qualification:
	Regular / RPL variants of National Craft Instructor Certificate (NCIC) in relevant trade
	OR
	Regular / RPL variants of NCIC in RoDA / D'man (Mech /civil) or any of its variants under DGT.
4. Employability Skill	MBA/BBA/Any Graduate/Diploma in any discipline with Two years' experience with short term ToT Course in Employability Skills.
	(Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above)
	OR
	Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills.

5. Minimum Age for Instructor	21 Years
List of Tools and Equipment	As per Annexure – I

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

5.1 LEARNING OUTCOMES

FIRST YEAR:

1. Identify& comply with the safe working practices, environmental regulation and housekeeping. (NOS: CSC/N1335)
2. Perform milling operations on simple components. (NOS: CSC/N0116)
3. Perform Turning simple operations on simple parts. (NOS: CSC/N0115)
4. Execute operations of unconventional machining processes. (NOS: CSC/N9408)
5. Identify customer needs & Product specification. (NOS: CSC/N0115)
6. Draw and Interpret industrial engineering drawing & its requirements. (NOS: CSC/N0115)
7. Construct the detail drawing of Machining stages. (NOS: CSC/N9401)
8. Check the quality of surface finish adhering to Surface roughness factor. (NOS: CSC/N0115)
9. Identify the measuring instruments and inspect the quality of final product. (NOS: CSC/N0115)
10. Identify the cutting tools & apply work-piece holding techniques. (NOS: CSC/N0115)
11. Perform conventional and non-conventional (CNC Technology) manufacturing processes. (NOS: CSC/N0115)
12. Apply M code & G Code used in CNC & VMC machines. (NOS: CSC/N0115,CSC/N0116)
13. Perform Computer aided machining & Wire-frame Geometry Creation, Surface and Solid Modeling, Dimension, Importing and Exporting of files. (NOS: CSC/N0120,CSC/N0123)
14. Verify Tool path Generation & Programming by using Computer Aided Manufacturing Software. (NOS: CSC/N0120,CSC/N0123)
15. Explain the need of CNC turning, VMC machines & the machining component. (NOS: CSC/N0120,CSC/N0123)
16. Explain the need of advanced CNC Turning Centre. (NOS: CSC/N0120)
17. Perform operation on advanced CNC Turning Centre. (NOS: CSC/N0115)
18. Identify CNC machines over travel limits & emergency stop, machine parts, various modes in CNC machines (Jog, MDI, Edit, Auto, Single Block, MPG) (NOS: CSC/N0120)
19. Run the CNC program or subprogram. (NOS: CSC/N0120)
20. Perform Programming of advanced CNC Turning Centre. (NOS: CSC/N0120)
21. Create and edit the Linear interpolation, Rapid traverse program of CNC turning center. (NOS: CSC/N0120)
22. Create and edit the Circular interpolation CW & CCW programs in turning center. (NOS: CSC/N0120)
23. Demonstrate Tool nose radius compensation in CNC turning program. (NOS: CSC/N0120)
24. Program Drilling cycles, boring cycle etc. in CNC turning center. (NOS: CSC/N0120)

25. Create Absolute & Incremental program in CNC turning center. (NOS: CSC/N0120)
26. Perform Importing & Exporting of CNC turning Program. (NOS: CSC/N0120)
27. Perform preventive maintenance & basic trouble shooting of CNC turning center. (NOS: CSC/N0115)
28. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)
29. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)

SECOND YEAR:

30. Operate advanced VMC machine. (NOS: CSC/N0116)
31. Identify VMC machines over-travel limits & emergency stop, different machine parts, different mode used (Jog, MDI, Edit, Auto, Single Block, MPG). (NOS: CSC/N0123)
32. Perform VMC movements by using G code & M code. (NOS: CSC/N0123)
33. Create Programming of advanced VMC machine. (NOS: CSC/N0123)
34. Perform Importing & Exporting of VMC Program. (NOS: CSC/N0123)
35. Create Tool paths & Verify with the help of graphical icon on machine control panel. (NOS: CSC/N0123)
36. Perform VMC preventive maintenance & basic trouble shooting. (NOS: CSC/N0116)
37. Explain the need of 3,4 & 5 Axis Machine. (NOS: ISC/N9416)
38. Perform Operating & programming of 4 Axis Machine. (NOS: ISC/N9417)
39. Perform Operating & programming 5 Axis Machine. (NOS: ISC/N9418)
40. Demonstrate Programming & tool path simulation of 4 axes and 5 axes with the help of computer aided machining software. (NOS: ISC/N9419)
41. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)
42. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)

LEARNING OUTCOMES	ASSESSMENT CRITERIA
FIRST YEAR	
1. Identify & comply with the safe working practices, environmental regulation and housekeeping. (NOS: CSC/N1335)	Demonstrate use of Personal Protective Equipment (PPE).
	Exhibit First Aid Method and basic training.
	Precautions to be followed while working.
	Demonstrate Safe use of tools and equipment used in the trade.
	Exhibit use of Fire Extinguishers in case of Fire.
2. Perform milling operations on simple components. (NOS: CSC/N0116)	Work piece setup on Milling Machine.
	Loading and unloading of cutting tools.
	Identify the tool life.
	Select proper G and M codes in MDI mode or make a small program for simple operation.
	Perform basic operations like step milling, slot milling, angle milling etc.
3. Perform Turning operations on simple parts. (NOS: CSC/N0115)	Identify the work holding devices, like three jaw and four jaw chucks and face plates.
	Component clamping and trueing.
	Performing simple metal cutting operations like OD turning, facing, taper turning, grooving etc.
	Inspect the product quality by using measuring instrument.
4. Execute operations of unconventional machining processes. (NOS: CSC/N9408)	Explain Unconventional Machining Operations- Laser-Beam machining (LBM).
	Identify Abrasive jet machining (AJM).
	Explain Ultrasonic machining (USM).
	Identify Electro- chemical machining (ECM).
	Explain Plasma ARC machining (PAM).
5. Identify customer needs & Product specification. (NOS: CSC/N0115)	Create check List of customer needs.
	Refinement in Customer needs and create product specification.
	Develop product specification report.
6. Draw and Interpret industrial engineering drawing & its requirements. (NOS: CSC/N0115)	Read & interpret engineering drawing.
	Create a checklist of dimensions & customer specific requirements.
	Ascertain types of operations to be done.
7. Construct the detail drawing of Machining stages. (NOS: CSC/N9401)	Create machining set up stage detail drawing.
	Prepare process flow diagram of machining operation.
	Check process flow diagram of machining operation for its correctness.

8. Check the quality of surface finish adhering to Surface roughness factor. (NOS: CSC/N0115)	Understanding of different surface roughness symbols.	
	Identifying the machining process with help of surface finish symbol.	
	Decide speed / feed required for required surface finish	
9. Identify the measuring instruments and inspect the quality of final product. (NOS: CSC/N0115)	Select appropriate measuring instrument.	
	Create product quality inspection report.	
	Prepare check sheet / report to confirming product quality before dispatch.	
10. Identify the cutting tools &apply work-piece holding techniques. (NOS: CSC/N0115)	Identify cutting tools& its Holders.	
	Select and hold appropriate cutting tool.	
	Use jigs & fixture for work piece holding using basic engineering principles.	
11. Perform conventional and non-conventional (CNC Technology) manufacturing processes. (NOS: CSC/N0115)	List out the conventional manufacturing processes.	
	List non- conventional manufacturing processes.	
	Explain Industrial revolution 4.0	
	Prepare check list of basic standard operating procedure of CNC machine.	
12. Apply M code & G Code used in CNC & VMC machines. (NOS: CSC/N0115,CSC/N0116)	Identify the G code & list out the machine movement.	
	Identify M code & list out the machine movement.	
	Understand safe starting codes.	
	Create simple turning programme using G code & M code.	
13. Perform Computer aided machining & Wire-frame Geometry Creation, Surface and Solid Modeling, Dimension, Importing and Exporting of files. (NOS: CSC/N0120,CSC/N0123)	List out the benefits of computer aided machining/ manufacturing technologies.	
	Create a model using geometric creation tool.	
	Importing & exporting of sample library files.	
14. Verify Toolpath Generation & Programming by using Computer Aided Manufacturing Software. (NOS: CSC/N0120,CSC/N0123)	Generate Toolpath using CAM software.	
	Verification Programming by using simulator	
	Generated NC program and transfer to machine by using transfer media.	
	Export the generated NC program for machining process	
15. Explain the need of CNC turning, VMC machines & the machining component. (NOS:	Identify the manufacturing process for CNC turning or Milling operation.	
	Understand the number of components to be machined.	
	Selection of machining process to meet design shape intent.	

CSC/N0120,CSC/N0123)	Mount fixture and set its work coordinates.
16. Explain the need of advanced CNC Turning Centre. (NOS: CSC/N0120)	Identifying the CNC turning center features & its components.
	Set the program and fixture for mass production.
	Select the cutting tools & holders for simple step turning CNC Turning operation.
17. Perform operation on advanced CNC Turning Centre. (NOS: CSC/N0115)	Start the machine by following standard operating procedure of Machine.
	Referencing of machine axis.
	Referencing of tool holder/ turret.
	Identify the wear out cutting tools & replace the cutting tool.
	Resetting the tool wear offset value.
18. Identify CNC machines over travel limits & emergency stop, machine parts, various modes in CNC machines (Jog, MDI, Edit, Auto, Single Block, MPG). (NOS: CSC/N0120)	Set tool offset with the help of jog mode.
	Set the maximum bed travel limit with the help of jog mode.
	Create a program and run with multiple functional option.
	Edit a created program.
19. Run the CNC program or subprogram. (NOS: CSC/N0120)	Select the program & run sub program from the main program by controlling speed & feed.
	Call sub program in main program.
	Explain codes for entering in sub program and going back to main program.
20. Perform Programming of advanced CNC Turning Centre. (NOS: CSC/N0120)	Identify and select tooling as per machining material.
	Create a program& dry run the same physical verification of program.
	Create& edit in the existing program.
21. Create and edit the Linear interpolation, Rapid traverse program of CNC turning center. (NOS: CSC/N0120)	Create and run program with G00 and dry run the machine
	Create and run program with G01 and dry run the machine
22. Create and edit the Circular interpolation CW & CCW programs in turning center. (NOS: CSC/N0120)	Create and run MDI program with G02 and dry run the machine.
	Create and run MDI program with G03 and dry run the machine.
	Create and run circular interpolation by R.
	Create and run circular interpolation by I, J, K method.
23. Demonstrate Tool nose radius compensation in CNC turning program.	Create and run MDI program to verify with G40 & run with single block mode option.
	Create and run MDI program to verify with G41 & run with single

(NOS: CSC/N0120)	block mode option.
	Create and run MDI program to verify with G42 & run with single block mode option.
24. Program Drilling cycles, boring cycle etc. in CNC turning center. (NOS: CSC/N0120)	Create and run MDI program to verify G81 the operation by dry run option.
	Create and run MDI program to verify G82 the operation by dry run option.
25. Create Absolute & Incremental program in CNC turning center. (NOS: CSC/N0120)	Create and run MDI program to verify G90 & run with single block mode option.
	Create and run MDI program to verify G91 & run with single block mode option.
26. Perform Importing & Exporting of CNC turning Program. (NOS: CSC/N0120)	Import external CNC program.
	Export CNC program through machine.
27. Perform preventive maintenance & basic troubleshooting of CNC turning center. (NOS: CSC/N0115)	Check & top up lubrication oil.
	Verify the clamp-declamp of spindle tool.
	Verifying machining center height.
28. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	Read & interpret the information on drawings and apply in executing practical work.
	Read & analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
29. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)	Solve different mathematical problems
	Explain concept of basic science related to the field of study
SECOND YEAR	
30. Operate advanced VMC machine. (NOS: CSC/N0116)	Start the machine by following standard operating procedure of machine.
	Referencing of machine axes.
	Referencing of tool holder/ turret.
	Tool wear offset.
	Identify the wear out cutting tools & replace the cutting tool.

		Resetting the tool wear offset after replacing the cutting tool.
31.	Identify VMC machines over-travel limits & emergency stop, different machine parts, different mode used (Jog, MDI, Edit, Auto, Single Block, MPG). (NOS: CSC/N0123)	Offset tool with the help of jog mode.
		Create a program in MDI mode.
		Create a program and run with single block option.
		Create a program and run with auto option mode.
32.	Perform VMC movements by using G code & M code. (NOS: CSC/N0123)	Create and run MDI program with various G code for Rapid traverse & M code and verifying the movements in machine.
		Create and run MDI program with various G code for feed travel.
		Create and run the program for absolute position.
		Create and run the program for incremental position.
33.	Create Programming of advanced VMC machine. (NOS: CSC/N0123)	Identify and select tooling as per machining material.
		Create a program & dry run the same physical verification of program.
		Create& edit in the existing program.
34.	Perform Importing & Exporting of VMC Program. (NOS: CSC/N0123)	Importing of external program.
		Exporting of VMC program through machine.
		Make various folders in memory for types of jobs/ customer wise / Operator wise.
35.	Create Tool paths & Verify with the help of graphical icon on machine control panel. (NOS: CSC/N0123)	Create a complex machining part program with the help of Advance computing software.
		Identify the tool path by VPS graphical ICON system.
36.	Perform VMC preventive machine maintenance & basic troubleshooting. (NOS: CSC/N0116)	Check & top up lubrication oil.
		Verify the clamp-de clamp arm for automatic tool changer.
		Lubricate the telescope.
		Tightening & verifying of spindle belt.
37.	Explain the need of3, 4& 5 Axis Machine. (NOS: ISC/N9416)	Verify part drawing and identify requirement of 4th or 5th axis requirement.
		Identify the axis & define the machining operation over the particular axis by taking complex shape from mold & dies industries.
		Explain referencing of 4th axis.
38.	Perform Operating & programming of 4 Axis Machine. (NOS: ISC/N9417)	Referencing of 4 axis machine.
		Referencing of ATC (Automatic tool changer).
		Operating of 4 Axis machine.
		Identifying and replacing of machining cutting tool.
		Programming & set up of axis machine.

39.	Perform Operating& programming of 5 Axis Machine. (NOS: ISC/N9418)	Referencing of 4 axis machine.
		Referencing of ATC (Automatic tool changer).
		Operating of 4 Axis machine.
		Identifying and replacing of machining cutting tool.
		Programming & set up of axis machine.
40.	Demonstrate Programming & tool path simulation of 4 axes and 5 axes with the help of computer aided machining software. (NOS: ISC/N9419)	Generate tool path in CAM for 4th axis.
		Simulate the programme of 4th axis and 5th axis machine.
		Create & Modify multi axis drill toolpath.
41.	Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	Read & interpret the information on drawings and apply in executing practical work.
		Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
		Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
42.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)	Solve different mathematical problems
		Explain concept of basic science related to the field of study

		SYLLABUS FOR ADVANCED CNC MACHINING TECHNICIAN TRADE	
		FIRST YEAR	
Duration	**Reference Learning Outcomes**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 20 Hrs.; Professional Knowledge 04 Hrs.	Identify & comply with the safe working practices, environmental regulation and housekeeping. (NOS: CSC/N1335	1. Importance of safety training, List of cutting tools & Machinery used in the workshop. (02 Hrs.) 2. Basic need of Personal Protective Equipment (PPE). (02 Hrs.) 3. First Aid Method and basic training. (02 Hrs.) 4. Safe disposal of waste materials like cotton waste, metal chips/burrs etc.(01 Hr.) 5. Hazard identification and avoidance. (02 Hrs.) 6. Safety signs for Danger, 7. Warning, caution &personal safety message. (02 Hrs.) 8. Preventive measures for electrical accidents & steps to be taken in such accidents. (03 Hrs.) 9. Identifying different types of Fire Extinguishers, and their use in case of Fire.(02 Hrs.) 10. Practice and understand precautions to be followed while working in fitting jobs. (02 Hrs.) 11. Safe use of tools and equipment's used in the trade. (02Hrs.)	• All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. • Soft Skills, its importance and Job area after completion of training. • Importance of safety and general precautions observed in the in the industry/shop floor. • Introduction of First aid. Operation of electrical mains and electrical safety. Introduction of PPEs. • Response to emergencies e.g.; power failure, fire, and system failure. • Importance of housekeeping & good shop floor practices. Introduction to 5S concept & its application. • Occupational Safety & Health: Health, Safety and Environment guidelines, legislations & regulations as applicable. • Basic understanding on Hot work, confined space work

			and material handling equipment.
Professional Skill 20Hrs.; Professional Knowledge 04 Hrs.	Perform milling operations on simple components. (NOS: CSC/N0116)	12. Work piece setup on Milling Machine, aligning the component. (04Hrs.) 13. Loading unloading of cutting tool in spindle. (05 Hrs.) 14. Selecting the proper feed and speeds. (03 Hrs.) 15. Segregate ok and worn out cutting tools. (03 Hrs.) 16. Perform basic operations like step milling, slot milling, angle milling etc.(05Hrs.)	History & development of CNC technology. Different types of milling machine configurations like horizontal, vertical, Knee type, universal head type etc. Different types of Tools used and the method of clamping. Fundamentals of Cutting speed, feed. Identification of worn out tools.
Professional Skill 20Hrs.; Professional Knowledge 04Hrs.	Perform Turning simple operations on simple parts. (NOS: CSC/N0115)	17. Hold a work piece in manual chuck and true it. (03 Hrs.) 18. Performing OD turning operations and inspect produced part quality. (03 Hrs.) 19. Performing grooving operations and inspect produced part quality. (03 Hrs.) 20. Performing Face turning operations and inspect produced part quality. (03 Hrs.) 21. Performing taper turning operations and inspect produced part quality. (04 Hrs.) 22. Perform drilling operation (02 Hrs.) 23. Perform boring open (02 hrs)	Fundamentals of work piece rotation. Three jaw / four jaw chucks / face plate clamping of work piece. Tool post, tail stock and its setting to adjust taper. Center height adjustment of Tool Orientation of simple turning operation. Inspection quality of product by using measuring instruments like Vernier, micrometer etc.
Professional Skill 20Hrs. Professional Knowledge 04 Hrs.	Execute operations of unconventional machining processes. (NOS: CSC/N9408)	24. List out the application of Abrasive jet machining (AJM). (03 Hrs.) 25. List out the application of Ultrasonic machining (USM). (04 Hrs.) 26. List out the application of	Knowledge of Unconventional Machining Operations like: Abrasive jet machining (AJM) Ultrasonic machining (USM) Electro-chemical machining (ECM) Plasma ARC machining

		Electro-chemical machining (ECM). (04 Hrs.) 27. List out the application of Plasma ARC machining (PAM). (04 Hrs.) 28. List out the application of Laser-Beam machining (LBM). (05Hrs.)	(PAM)Laser-Beam machining (LBM)
Professional Skill 20Hrs.; Professional Knowledge 04 Hrs.	Identify customer needs & Product specification. (NOS: CSC/N0115)	29. Prepare check List of customer needs. (07 Hrs.) 30. Refinement in customer needs & select optimum requirement. (04 Hrs.) 31. Develop product specification report. (09Hrs.)	Introduction to product design and development. Customer's requirements &specification. Importance of customer relationship management.
Professional Skill 20Hrs.; Professional Knowledge 04Hrs.	Draw and Interpret industrial engineering drawing & its requirements. (NOS: CSC/N0115)	32. Reading of industrial drawing. (04Hrs.) 33. List out the symbols used in industrial drawing. (02 Hrs.) 34. Create a checklist of dimensions & customer specific requirements.(04Hrs.) 35. Apply the Geometric dimension & tolerances Symbol on drawing to intent of component in assembly of final product. (10 Hrs.)	Introduction to engineering drawing. Fundamentals of limits fits & tolerances & symbols. Importance of inter change ability & ISO standards. Understand industrial Engineering special Characteristic symbol, Customer specific standards drawing and notation, geometrical dimensions & tolerances. Symbols used in Industrial machining drawing like surface finish, machining operation, surface treatment, GD&T, etc.
Professional Skill 20Hrs.; Professional Knowledge 03Hrs.	Construct the detail drawing of Machining stages. (NOS: CSC/N9401)	36. Create the machining operation process flow diagram. (05 Hrs.) 37. Create blanking operation stage detail drawing for step turning operation. (05Hrs.) 38. Create CNC/VMC 1st set up stage detail drawing for step turning operation. (05 Hrs.)	Introduction to machining procedure from raw material to finished product. Concept of process flow of machining operation. Concept Work-piece holding. Importance of multi stage drawing.

		39. Create 2nd Set up stage detail drawing for step turning. (05Hrs.)	
Professional Skill 20Hrs.; Professional Knowledge 05Hrs.	Check the quality of surface finish adhering to Surface roughness factor. (NOS: CSC/N0115)	40. List out the importance of surface finish (04 Hrs.) 41. Identify the surface finish requirement. (04Hrs.) 42. Apply surface finish symbol on machining parameter. (08Hrs.) 43. Improve surface finish quality by using post process manufacturing operation. (04Hrs.)	Introduction to surface finish and its' Importance. International standards & symbols used to represent surface finish Concept of surface finish calculation of Ra, Rt, Rz, R3z, etc. Introduction to improve surface finish quality. Introduction of post process manufacturing operation to improve surface finish quality.
Professional Skill 40 Hrs.; Professional Knowledge 08 Hrs.	Identify the measuring instruments and inspect the quality of final product. (NOS: CSC/N0115)	44. Perform calibration& Gage R & R of instruments. (04 Hrs.) 45. Select appropriate instrument to measure the component like Vernier caliper, micrometer. (10Hrs.) 46. Prepare quality / inspection check list for confirming the product quality. (08Hrs.) 47. Create incoming inspection report. (05Hrs.) 48. Create in process inspection report. (05Hrs.) 49. Create final pre-dispatch inspection report. (04Hrs.) 50. Before dispatch make check sheet report to confirming product quality before dispatch. (04Hrs.)	Introduction to quality of product. Concept of quality control & quality assurance of product. Introduction to inspection instruments. Importance of calibration of inspection instruments. Inspection instrument handling Standard guidelines / procedure to minimize the human error. Concept of inspection instruments Gage Repeatability and Reproducibility (Gage R & R) Types of inspection reports.
Professional Skill 40 Hrs.; Professional Knowledge 08Hrs.	Identify the cutting tools &apply work-piece holding techniques. (NOS: CSC/N0115)	51. Understand how multi- point cutting tool is named. (6 Hrs.) 52. Identify cutting tools & Holders. (7 Hrs.) 53. Hold single point cutting tool and perform operation. (10 Hrs.)	Understand the cutting tools, holders & its types. Nomenclature of cutting tools & its machining process parameter. Selection of cutting tools & Holders Cutting fluid & its

		54. Add soluble cutting oil in water for a proper concentration of coolant how to check coolant concentration. (7 Hrs.) 55. Mount a drilling jig to hold square block to perform operation. (10Hrs.)	importance Selection of cutting fluid & coolant used for machining. Concept of work piece holding devices and references. What are work-piece holding devices. Understand the Jigs & fixture.
Professional Skill 20Hrs.; Professional Knowledge 05Hrs.	Perform conventional and non-conventional (CNC Technology) manufacturing processes. (NOS: CSC/N0115)	56. List out the manufacturing processes (8 Hrs.) 57. List out the non-conventional manufacturing processes. (04Hrs.) 58. Nomenclature of CNC machine components. (04Hrs.) 59. Create the check list of basic standard operating procedure of CNC machine to ensure safe working practices. (04Hrs.)	Introduction Industrial evolution. Introduction to CNC machine working principal. History & development of CNC technology. Conventional Vs. non-conventional machine tools. Concept of Numerical control on CNC machine tools and CNC Control.
Professional Skill 40 Hrs.; Professional Knowledge 07 Hrs.	Apply M code & G Code used in CNC & VMC machines. (NOS: CSC/N0115,CSC/N0116)	60. Identify the G code as per requirements (e.g. G21 - Programming in millimeters). (20 Hrs.) 61. Identify the M code as per requirements (e.g. M08 – Coolant on). (12Hrs.) 62. Use various cycle end codes. (08 Hrs.)	Introduction to G code. Introduction to M code Concept of block number, end of block.
Professional Skill 40Hrs.; Professional Knowledge 08Hrs.	Perform Computer aided machining & Wire-frame Geometry Creation, Surface and Solid Modeling, Dimension, Importing and Exporting of files. (NOS: CSC/N0120,CSC/N	63. List out the computer aided manufacturing software & its industrial application. (08 Hrs.) 64. Customize the quick access tool bar. (08 Hrs.) 65. Customize the ribbon.(08 Hrs.) 66. Importing & exporting of sample library files.(08 Hrs.) 67. Creation of 3D solid modeling geometry.(08 Hrs.)	Introduction to the computer aided manufacturing software. Learn all its syntax. Open / modify a file in CAM software Concept of toolbar & ribbon Setting attribute & user interface orientation.

	0123)		
Professional Skill 40 Hrs.; Professional Knowledge 08 Hrs.	Verify Toolpath Generation & Programming by using Computer Aided Manufacturing Software. (NOS: CSC/N0120,CSC/N0123)	68. Import the 3D model. (04 Hrs.) 69. List out the importance of toolpath generation. (04 Hrs.) 70. Select and upload cutting tool library in CAM software. (05 Hrs.). 71. Run the simulation tool on 3D model for virtual verification of tool path. (08 Hrs.) 72. Generate a NC Program by using Computer Aided Manufacturing Software. (15 Hrs.) 73. Export the generated NC program for machining process. (04Hrs.)	Import the 3D model Start machine simulation in Computer Aided Manufacturing Software. Run a simulation in Computer. Aided Manufacturing Software. Generate the NC Program. Export the NC program for machining.
Professional Skill 20Hrs.; Professional Knowledge 05Hrs.	Explain the need of CNC turning, VMC machines & the machining component. (NOS: CSC/N0120,CSC/N0123)	74. Identify the manufacturing process. (4 Hrs.) 75. Select machining sequence for part program to meet design shape intent. (08 Hrs.) 76. Select the machine (CNC & VMC) to achieve designed shape. (08Hrs.)	Introduction to manufacturing processes. Concept of machining a component & its process. Design concept in assembly of parts, its tolerances mentioned in drawing to perform designed task. Introduction to CNC lathe & VMC milling machine. Concept of NC machine controllers (Fanuc, Sinumeric, Mitsubishi, etc.) Importance Emergency stop key on machine.
Professional Skill 25Hrs.; Professional Knowledge 05Hrs.	Explain the need of advanced CNC Turning Centre. (NOS: CSC/N0120)	77. Identifying the CNC turning center features & its components. (15 Hrs.) 78. Select the cutting tools & holders for simple step turning CNC turning	Introduction to CNC turning Centre & its Coordinate System Cutting tools & holder for CNC turning center. Work-piece holding devices.

		operation. (10Hrs.)	Introduction Turn mill Centre/ Dual spindle / Sub Spindle.
Professional Skill 40Hrs.; Professional Knowledge 07 Hrs.	Perform operation on advanced CNC Turning Centre. (NOS: CSC/N0115)	79. Start machine by following the standard operating procedure of machine. (08 Hrs.) 80. Referencing of machine axes (04 Hrs.) 81. Referencing of tool holder/ turret. (04 Hrs.) 82. Identify the axes of machine + and – travel of axes& travel range of tool holder turret. (04 Hrs.) 83. Run the program in single block set up by adjusting speed, feed & depth of cut. (04 Hrs.) 84. Inspect the operating parameter defined in machining control plan. (04 Hrs.) 85. Run the program in auto mode in single block. (04 Hrs.) 86. Identify the wear out cutting tools & replace the cutting tool. (04 Hrs.) 87. Resetting the tool wear offset. (04Hrs.)	Operating of Advanced CNC Turning Centre Concept of axis & Coordinate System used in CNC turning Centre. Overview of Control Panel Key functions. Identifying & replacing of cutting tools in CNC turning Centre. Concept of tool wear & offsets used for machining Reading of machining control plan & understanding of operating parameter inspection.
Professional Skill 40Hrs.; Professional Knowledge 08 Hrs.	Identify CNC machines over travel limits & emergency stop, machine parts, various modes in CNC machines (Jog, MDI, Edit, Auto, Single Block, MPG). (NOS: CSC/N0120)	88. Taking tool offset with the help of jog mode.(15 Hrs.) 89. Find out the maximum bed travel limits in jog mode. (04 Hrs.) 90. Create a program in MDI mode. (03 Hrs.) 91. Create a program and run with single block option. (03 Hrs.) 92. Search an existing program and edit on same page. (15	Concept of CNC turning center over travel limits. Importance Emergency stop function key. Concept of CNC turning center mode like Jog, MDI, Edit, Auto, Single Block, MPG.

		Hrs.)	
Professional Skill 25Hrs.; Professional Knowledge 04 Hrs.	Run the CNC program or subprogram. (NOS: CSC/N0120)	93. Create a program using subroutine codes 94. Select the program& run sub program from the main program by controlling speed & feed. (25Hrs.)	Concept of sub programming Concept of block in CNC turning programming.
Professional Skill 120 Hrs.; Professional Knowledge 25 Hrs.	Perform Programming of advanced CNC Turning Centre. (NOS: CSC/N0120)	95. Identify and select tooling as per machining material (15 Hrs.) 96. Create a simple step milling & face milling programming. (15 Hrs.) 97. Create a complex machining part program with the help of advance CAM software. (15 Hrs.) 98. Make a Work-piece setup. (10 Hrs.) 99. Create a program using canned cycle feature. (15 Hrs.) 100. Calculatemachine operator efficiency with the help cycle time (20 Hrs.) 101. Create a program of Grooving/Threading on OD/ID in CNC turning. (15 Hrs.) 102. Threading cycle on OD Sub program with repetition. (15 Hrs.)	Introduction to advanced CNC Turning Centre Programme Selection of Tools depending on material to be cut. Concept of G Codes and M Codes used in machine programming. Program creation tools & techniques. Generation of complex machining part program with the help of advance CAM software. Tool path optimization Cycle time calculation. Machine offset Cutter tool nose radius Compensation. Concept of Interpolation and Canned Cycles.
Professional Skill 25Hrs.; Professional Knowledge 04 Hrs.	Create and edit the Linear interpolation, Rapid traverse program of CNC turning center. (NOS: CSC/N0120)	103. List out the importance of GOO code in program. (05Hrs.) 104. List out the importance of GO1 code in program. (05Hrs.) 105. Create MDI program to verify (G00 & G01) Linear interpolation & Rapid traverse. (15Hrs.)	Orientation of machine movement. Identify the direction of machine movement by using Jog mode. Concept of tool travel with Linear interpolation. Rapid traverse.

Professional Skill 25 Hrs.; Professional Knowledge 04 Hrs.	Create and edit the Circular interpolation CW &CCW programs in turning center. (NOS: CSC/N0120)	106. Create MDI program to verify (G02) Circular interpolation CW. (10 Hrs.) 107. Create MDI program to verify (G03) Circular interpolation CCW. (10 Hrs.) 108. Manual generation of circular interpolation by using I, j code. (05 Hrs.)	Concept of spindle set up to Circular interpolation CW& Circular interpolation CCW Concept of circular interpolation by using I, j code
Professional Skill 25Hrs.; Professional Knowledge 04 Hrs.	Demonstrate Tool nose radius compensation in CNC turning program. (NOS: CSC/N0120)	109. Create MDI program to verify (G41) Tool nose radius compensation left. (05 Hrs.) 110. Create MDI program to verify (G42) Tool nose radius compensation right. (05 Hrs.) 111. Create MDI program to verify (G40), tool nose radius cutter compensation cancel. (15 Hrs.)	Concept of Tool nose radius compensation. Its impact on shape of part & cutting tool life. Explain codes used for Tool nose radius compensation.
Professional Skill 25Hrs.; Professional Knowledge 04 Hrs.	Program Drilling cycles, boring cycle etc. in CNC turning center. (NOS: CSC/N0120)	112. Create MDI program to verify Drilling cycle. (05 Hrs.) 113. Create MDI program to spot boring cycle. (05 Hrs.) 114. Create MDI program using canned cycle. (10 Hrs.) 115. Create MDI program to wood picking cycle. (05 Hrs.)	Concept of live tool & set up. Concept of Drilling cycle, spot boring cycle. Concept of canned cycle & wood picking cycle.
Professional Skill 25Hrs.; Professional Knowledge 04 Hrs.	Create Absolute & Incremental program in CNC turning center. (NOS: CSC/N0120)	116. Create MDI program to verify (G90) Absolute programming. (15 Hrs.) 117. Create MDI program to verify (G91) Incremental programming. (10Hrs.)	Concept & impact of Absolute programming. Concept of Incremental programming in CNC turning program.
Professional Skill 25Hrs.;	Perform Importing & Exporting of CNC	118. Create the directory of program. (05 Hrs.)	Importance of program exchange between system and

Professional Knowledge 04 Hrs.	turning Program. (NOS: CSC/N0120)	119. Classification of program and creation of directory folders as per operator, job, customer etc. (10 Hrs.) 120. Importing of external CNC machining program. (05 Hrs.) 121. Exporting of CNC program through machine. (05Hrs.)	machine. Concept of importing & exporting of CNC program.
Professional Skill 40 Hrs.; Professional Knowledge 07 Hrs.	Perform preventive maintenance & basic troubleshooting of CNC turning center. (NOS: CSC/N0115)	122. Check & top up lubrication oil. (08 Hrs.) 123. Verify the clamp-de-clamp spindle. (08 Hrs.) 124. Verifying machining center height. (04Hrs.) 125. Explain pillars of TPM and its importance in improving production. (10 Hrs.) 126. Explain Autonomous maintenance. (10 Hrs.)	Basic maintenance of VMC and turning machine. Preventive maintenance. Basic troubleshooting of CNC machine. Introduction to TPM (Total Productive Maintenance)
Engineering Drawing: (40 hrs)			
Professional Knowledge ED- 40	Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	**Engineering Drawing:** Introduction to Engineering Drawing and Drawing Instruments – • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument Lines- Types and applications in drawing Free hand drawing of – • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the free hand sketches. • Free hand drawing of hand tools and measuring tools. Drawing of Geometrical figures: • Angle, Triangle, Circle, Rectangle, Square, Parallelogram. • Lettering & Numbering – Single Stroke. Dimensioning - • Types of arrowhead • Leader line with text • Position of dimensioning (Unidirectional, Aligned) Symbolic representation – • Different symbols used in the related trades. Concept and reading of Drawing in	

		• Concept of axes plane and quadrant
		• Concept of Orthographic and Isometric projections
		• Method of first angle and third angle projections (definition and difference)
		Reading of Job drawing of related trades.
Workshop Calculation & Science: (38 Hrs.)		
Professional Knowledge WCS- 38	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)	**Workshop Calculation & Science:** **Unit, Fractions** • Classification of unit system • Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units • Measurement units and conversion • Factors, HCF, LCM and problems • Fractions - Addition, substraction, multiplication & division • Decimal fractions - Addition, subtraction, multilipication & division • Solving problems by using calculator **Square root, Ratio and Proportions, Percentage** • Square and suare root • Simple problems using calculator (Only direct problems) • Applications of pythagoras theorem and related problems • Ratio and proportion • Ratio and proportion - Direct and indirect proportions • Percentage • Precentage - Changing percentage to decimal and fraction **Material Science** • Types metals, types of ferrous and non ferrous metals • Physical and mechanical properties of metals • Introduction of iron and cast iron • Difference between iron & steel, alloy steel and carbon steel • Properties and uses of insulating materials **Mass, Weight, Volume and Density** • Mass, volume, density, weight and specific gravity **Speed and Velocity, Work, Power and Energy** • Work, power, energy, HP, IHP, BHP and efficiency (Definition only) **Heat & Temperature and Pressure** • Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals • Transmission of heat - Conduction, convection and radiation • Co-efficient of linear expansion **Basic Electricity** • Introduction and uses of electricity, molecule, atom, how

		electricity is produced, electric current AC,DC their comparison, voltage, resistance and their units
		Mensuration
		• Area and perimeter of square, rectangle and parallelogram
		• Area and perimeter of Triangles
		• Area and perimeter of circle, semi-circle, circular ring, sector of circle, hexagon and ellipse
		• Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder
		• Finding the lateral surface area, total surface area and capacity in litres of hexagonal, conical and cylindrical shaped vessels
		Trigonometry
		• Measurement of angles
		• Trigonometrical ratios
		• Trigonometrical tables

In-plant training/ Project work

Broad area:

a) Visit to CNC manufacturing industry/ nearby industry involving CNC operation for production purpose.

b) Conduct preventive maintenance of workshop available CNC turning center.

c) Performing job work as per industrial requirements.

	SYLLABUS FOR ADVANCED CNC MACHINING TECHNICIAN TRADE		
	SECOND YEAR		
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical) With Indicative Hours**	**Professional Knowledge (Trade Theory)**
Professional Skill 40 Hrs.; Professional Knowledge 12 Hrs.	Operate advanced VMC machine. (NOS: CSC/N0116)	127. Identifying the VMC Machining features & its components. (04 Hrs.) 128. Start the machine by following standard operating procedure through dialog box of machine. (04 Hrs.) 129. Referencing of machine axis. (04 Hrs.) 130. Referencing of tool holder/ turret. (04 Hrs.) 131. Identify the axis of machine & travel range of bed table. (04 Hrs.) 132. Run the program in single block set up by adjusting speed, feed & depth of cut. (04 Hrs.) 133. Check all operating parameter defined in machining control plan. (04 Hrs.) 134. Run the program in auto mode in single block. (04 Hrs.) 135. Identify the wear out cutting tools & replace the cutting tool. (04 Hrs.) 136. Resetting the tool wear offset. (04 Hrs.)	Introduction to Vertical Machining Centre. Concept of axis & Coordinate System. Overview of Control Panel Key Functions. Concept of speed, feed & machining depth of cut. Identifying & replacing of cutting tools. Concept of tool wear & offsets used for machining. Reading of machining control plan & understanding of operating parameter inspection.
Professional Skill 40 Hrs.; Professional	Identify VMC machines over-travel limits & emergency stop, different machine	137. Taking tool offset with the help of jog mode. (10 Hrs.) 138. Identify the maximum bed travel limit with the help of jog mode. (04 Hrs.)	Concept of over travel limits in VMC machines. Importance Emergency stop function key. Concept of VMC mode like

Knowledge 12 Hrs.	parts, different mode used (Jog, MDI, Edit, Auto, Single Block, MPG) (NOS: CSC/N0123)	139. Create a program in MDI mode. (07 Hrs.) 140. Create a program and run with single block option. (07 Hrs.) 141. Create a program and run with auto option mode. (07 Hrs.) 142. Find the existing program and edit on same page. (05Hrs.)	Jog, MDI, Edit, Auto, Single Block, MPG.
Professional Skill 25Hrs.; Professional Knowledge 07 Hrs.	Perform VMC movements by using G code & M code. (NOS: CSC/N0123)	143. Create MDI program to verify (G00 & G01) Linear interpolation & Rapid traverse. (05 Hrs.) 144. Create MDI program to verify (G02 & G03) Circular interpolation CW & Circular interpolation CCW. (05 Hrs.) 145. Create MDI program to verify (G40, G41 & G02) Tool nose radius compensation. (05 Hrs.) 146. Create MDI program to verify (G81 & G82) Drilling cycle, spot boring cycle. (05 Hrs.) 147. Create MDI program to verify (G90 & G91) Absolute programming & Incremental programming. (05 Hrs.)	Use of MDI function key. VMC Machine movement on various G codes & M codes.
Professional Skill 250 Hrs.; Professional Knowledge 60 Hrs.	Create Programming of advanced VMC machine. (NOS: CSC/N0123)	148. Identifying and selection of tooling as per machining material. (20 Hrs.) 149. Create a simple step milling & face milling programming. (20 Hrs.) 150. Run simple step milling & face milling program with MDI option. (20 Hrs.)	Introduction to VMC Machine Program. Concept machining material & Tooling selection. Concept of G Codes and M Codes used in machine programming. Program creation tools &

		151. Dry run the program for verifying actual tool path & foul with object. (25 Hrs.)	techniques. Cycle time calculation Machine. Work Piece Set Up Machine tool offset. Absolute and Incremental Positioning System. Cutter tool nose Compensation. Concept Interpolation and Canned Cycles.
		152. Run simple step milling & face milling program with single block option by varying speed & feed. (25 Hrs.)	
		153. Perform Work-piece setup. (25 Hrs.)	
		154. Take a tool work offset. (25 Hrs.)	
		155. Create a program using canned cycle feature. (25 Hrs.)	
		156. Calculate machine operator efficiency with the help cycle time. (20 Hrs.)	
		157. Linear interpolation &circular interpolation, assignments & simulations on software on old program Milling. (20 Hrs.)	
		158. Create a program& perform machining operation as per job card (Customer requirement). (25Hrs.)	
Professional Skill 25Hrs.; Professional Knowledge 07 Hrs.	Perform Importing & Exporting of VMC Program. (NOS: CSC/N0123)	159. Importing of external VMC machining program. (15 Hrs.) 160. Exporting of VMC program through machine. (10Hrs.)	Making a directory. Concept of importing & exporting of VMC program.
Profession al Skill 110 Hrs.; Professional Knowledge	Create Tool paths & Verify with the help of graphical icon on machine control panel. (NOS:	161. Create a complex machining part program with the help of advance computing software. (60 Hrs.)	Generation of complex machining part program with the help of advance computing software. Concept of Tool Path

28 Hrs.	CSC/N0123)	162. Identify the tool path by VPS system. (50Hrs.)	Verifications.
Profession al Skill 60 Hrs.; Professional Knowledge 28 Hrs.	Perform VMC preventive maintenance & basic troubleshooting. (NOS: CSC/N0116)	163. Check & top up lubrication oil. (10 Hrs.) 164. Verify the clamp-de clamp arm for automatic tool changer. (10 Hrs.) 165. Lubricate the telescope. (20 Hrs.) 166. Tightening & verifying of spindle belt. (10 Hrs.) 167. Preparing plan for Preventive maintenance.(10Hrs.)	Concept of machine maintenance & its types. Use of tool kit used for VMC preventive maintenance & basic troubleshoot. Preventive maintenance planning Prepare standard preventive maintenance operating procedure.
Professional Skill 40 Hrs.; Professional Knowledge 14 Hrs.	Explain the need of 3, 4& 5 Axis Machine. (NOS: ISC/N9416)	168. Identify the axis & define the machining operation over the particular axis by taking complex shape from mold & dies industries (40 Hrs.)	Concept Basic and Advanced Rotary axis. Control Training 4th and 5th axis perspective. Importance of multi axis coordinate machinery like 3, 4 & 5 axes.
Professiona l Skill 150 Hrs.; Professional Knowledge 34 Hrs.	Perform Operating & programming of 4 Axis Machine. (NOS: ISC/N9417)	169. Align 4thaxis on machine w. r. t. x, y and z axes. (20 Hrs.) 170. Referencing of 4 Axis machine. (20 Hrs.) 171. Referencing of ATC (Automatic tool changer). (25 Hrs.) 172. 4 Axis Machining – As Indexer Introduction. (20 Hrs.) 173. Operating of 4 Axis machine. (25Hrs.) 174. 4 Axis Rotary – Setup and Programming. (40 Hrs.)	Introduction to indexer & its importance. Concept 4 Axis Machining Indexer. Setting up an axis on machine. Introduction of referencing of 4th axis.
Professional Skill 60Hrs.; Professional Knowledge 12 Hrs.	Perform Operating & programming 5 Axis Machine. (NOS: ISC/N9418)	175. 5 Axis Machining – As Indexer Introduction. (20Hrs.) 176. 5 Axis Rotary – Setup and Programming. (20 Hrs.) 177. Evaluation of 5 axis	Introduction to indexer & its importance. Concept 5 Axis Machining Indexer. Different uses of 5th axis.

		machine. (20 Hrs.)	
Professional Skill 40 Hrs.; Professional Knowledge 12 Hrs.	Demonstrate Programming & tool path simulation of 4 axes and 5 axes with the help of computer aided machining software. (NOS: ISC/N9419)	178. Create & Modify multi-axis curve tool path. (20 Hrs.) 179. Create & Modify multi axis drill tool path. (20Hrs.)	Understand the basic architecture of multi-axis machine. Working with multi-axis tool path interface.
Engineering Drawing: (40 hrs)			
Professional Knowledge ED- 40	Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	**Engineering Drawing:** • Reading of drawing of nuts, bolt, screw thread, different types of locking devices e.g., Double nut, Castle nut, Pin, etc. • Reading of foundation drawing • Reading of Rivets and rivetted joints, welded joints • Reading of drawing of pipes and pipe joints • Reading of Job Drawing, Sectional View & Assembly view	
Workshop Calculation & Science: (34 Hrs.)			
Professional Knowledge WCS-34	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)	**Workshop Calculation & Science:** **Friction** • Friction - Advantages and disadvantages, Laws of friction, co-efficient of friction, angle of friction, simple problems related to friction • Friction - Lubrication • Friction - Co- efficient of friction, application and effects of friction in workshop practice **Centre of Gravity** • Centre of gravity - Centre of gravity and its practical application **Area of cut out regular surfaces and area of irregular surfaces** • Area of cut out regular surfaces - circle, segment and sector of circle • Related problems of area of cut out regular surfaces - circle, segment and sector of circle • Area of irregular surfaces and application related to shop problems **Elasticity** • Elasticity - Elastic, plastic materials, stress, strain and their units and young's modulus • Elasticity - Ultimate stress and working stress **Heat Treatment** • Heat treatment and advantages (Only overview required) • Heat treatment - Different heat treatment process –	

		Hardening, tempering, annealing, normalising and case hardening (Only overview required)
		Estimation and Costing
		• Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade • Estimation and costing - Problems on estimation and costing

In-plant training/ Project work

Broad area:

a) Visit to VMC manufacturing industry/nearby industry involving VM Cooperation for production.

b) Conduct preventive maintenance of workshop available VMC machine.

c) Performing job work as per industrial requirements.

SYLLABUS FOR CORE SKILLS
1. Employability Skills (Common for all CTS trades) (120 Hrs. + 60 Hrs.)

Learning outcomes, assessment criteria, syllabus and Tool List of Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in / dgt.gov.in

SI. No.	Name of the Tool & Equipment's	Specification	Quantity
LIST OF TOOLS AND EQUIPMENT			
ADVANCED CNC MACHINING TECHNICIAN (For 24 Candidates)			
A.TRAINEES TOOL KIT			
1.	Steel rule	30 cm & 60 cm graduated both in English & Metric units	24 Nos.
2.	Hand Gloves	_	24 Nos.
3.	Safety Shoes	_	24 Nos.
4.	Helmet	_	24 Nos.
B. GENERAL MACHINERY / SOFTWARE INSTALLATIONS			
5.	Computer Aided Manufacturing Software	--	24 Nos
6.	Vertical Machining Center	Center X: 406 x Y: 305 x Z: 254 mm BT40 40 taper, belt drive 5.6 kW vector drive 7.6 m/min, Rapids Early Power-Failure Detection Module Work Light 15" Color LCD, Monitor 1 GB Program Memory Lock Key switch Ethernet USB Port, Haas Connect Mobile App Internal Transformer 380-480 V Media Display MCode; M-130 Haas Window Blast	1 No.
7.	6K-40T vector drive spindle	6000 rpm 40 taper belt drive 7.5 HP / 5.6 kW	1 No.
8.	TC-10-EDU 10-Station Automatic Tool Changer	--	1 No.
9.	CPK-MM Coolant Pump Kit	1/4 hp (186 W),40-gallon (151 liter) tank; includes coolant level sensor	1 No.
10.	Servo Rotary Table	HRT160 160 mm (6.3")	1 No.
11.	4AXD 4th-Axis Drive and Wiring	-	1 No.
12.	VMC Simulator	Next Generation Control dual software (Mill &Lathe)	1 No.
13.	CNC Simulator	Next Generation Control; dual software	1 No
14.	Voltage Stabilizer	40 kVA	1 No.
15.	Reciprocating Air compressor	5 HP	1 No.

16.	Electrical cable	Standard	1 No.
17.	Copper Earthing Rod	Standard	1 No.
18.	Hand Tool Set	Standard	1 No.
19.	Clamping kit T16M14		1 No.
20.	Tooling Set BT40	Standard	1 No.
21.	Manual Vise for VF-2-I		1 No.
22.	Coolant concentrate		1 No.
23.	Tool trolley		1 No.
24.	4-Station Automatic Tool Turret		1 No.
25.	Coolant Pump Kit		1 No.
26.	Manual Tailstock		1 No.
27.	Manual 3-Jaw Scroll Chuck hard top reversible jaws		1 No.
28.	Computer Latest version	Compatible for running computer aided manufacturing software, preloaded with latest configurations and Internet connection with standard operating system.	10 Nos.
29.	UPS	3 KVA With Battery & Trolley	1 No.
30.	Industrial Workstation	32 GB RAM, NVIDIA Qdr 4GB, Intel XeonW-2123 3.6 4C, 1TB HDD, USB Keyboard & USB Optical Mouse	24 Nos.
31.	Monitor	IPS Display, Narrow Bezel	24 Nos.
32.	Server with rack	Intel Xeon Silver 4114 2.2G (or equivalent), 10C/20T,9.6GT/s, 14M Cache, Turbo, HT (85W) DDR4-2400, 600GB x 5nos. 10KRPM SAS, 12Gbps 512n 2.5in Hot plug Hard Drive	1 No.
33.	Air Compressor	3 HP	1 No.
34.	CNC Tool room Lathe	TL-1:Max. Cutting dia. 406 mm Max. Cutting Length 762 mm Max. Part Swing dia. 508 mm X: 203 mm / Z: 762 mm 1,800-rpm Spindle, A2-5 7.5 kW vector drive	1 No.

		11.4 m/min Rapids Early Power-Failure Detection Module Work Light 15" Color LCD Monitor 1 GB Program Memory, Memory Lock Key switch Ethernet USB Port Connect Mobile App Internal Transformer 380-480 V Media Display M-Code; M-130	
35.	4-Station Automatic Tool Turret	for 3/4" (20 mm) turning tools	1 No.
C. TOOLS, INSTRUMENTS AND GENERAL SHOP OUT FITS			
35.	"V" block	V-Block pair 7 cm with clamps	05 Nos.
36.	"V" block	V-Block 15 cm with clamps	05 Nos.
37.	Micrometer Outside	0-50 mm outside	10 Nos.
38.	Vernier Caliper	0-15 cm	10 Nos.
39.	Micrometer Inside	up to 20 mm	10 Nos.
40.	Metal L	Metal - L - 15cm	05 Nos.
41.	Metal L	Metal - L - 30cm	05 Nos.
42.	Angle Plate	10 x 20 cm.	05 Nos.
43.	Spirit Level	15 cm metal	05 Nos.
44.	File warding	15 cm smooth	10 Nos.
45.	File knife edge	15 cm smooth	10 Nos.
46.	File cut saw	15 cm smooth	10 Nos.
47.	File feather edge	15 cm smooth	10 Nos.
48.	File triangular	15 cm smooth	10 Nos.
49.	File round	20 cm second cut	10 Nos.
50.	File square	15 cm second cut	10 Nos.
51.	File square	25 cm second cut	10 Nos.
52.	File triangular	20 cm second cut.	10 Nos.
53.	File flat	30 cm second cut.	10 Nos.
54.	File flat	20 cm bastard	10 Nos.
55.	File flat	30 cm bastard.	10 Nos.
56.	File Swiss type	Needle set of 12.	10 Nos.
57.	File half round	25 cm second cut.	10 Nos.
58.	File half round	25 cm bastard.	10 Nos.
59.	File round	30 cm bastard.	10 Nos.
60.	File hand	15 cm second cut.	10 Nos.

61.	Card file.	----	10 Nos.
62.	Oil Stone	15 cm x 5 cm x 2.5 cm	10 Nos.
63.	Pliers combination	15 cm	10 Nos.
64.	Blow Lamp	0.50 liters.	10 Nos.
65.	Spanner	D.E. 6 -26 mm set of 10 pcs.	10 Nos.
66.	Spanner adjustable	15 cm	10 Nos.
67.	Box spanner	Set 6-25 mm set of 8 with Tommy bar.	10 Nos.
68.	Glass magnifying	7 cm	10 Nos.
69.	Clamp toolmaker	5 cm and 7.5 cm set of 2.	10 Nos.
70.	Clamp "C"	5 cm	10 Nos.
71.	Clamp "C"	10 cm	10 Nos.
72.	Scraper flat	15 cm.	10 Nos.
73.	Scraper triangular	15 cm	10 Nos.
74.	Scraper half round	15cm	10 Nos.
75.	Chisel	cold 9 mm cross cut 9 mm diamond.	10 Nos.
76.	Chisel	cold 19 mm flat	10 Nos.
77.	Chisel	cold 9 mm round nose.	10 Nos.
78.	Motorized +Tennon Saw	----	10 Nos.
79.	Hand hammer	1 kg. with handle Ball Peen	10 Nos.
80.	Hacksaw	frame fixed 30 cm.	10 Nos.
81.	Mallets Wooden	----	10 Nos.
82.	V-Block, Files, mallets, screwdrivers, chisels, etc.	----	10 Nos.
83.	Hand Drilling Machine	Rated input power: 600W, Power output: 301W, Rated torque: 1.8 Nm	10 Nos.
84.	Metal Saw	No-Load Speed: 3,800 rpm, Saw blade diameter 355 mm, Saw blade bore 25.4 mm	10 Nos.
85.	Straight Grinder HEAVY DUTY with attachments	No-Load Speed: 10000 – 30000 rpm, Rated power output: 380W	10 Nos.
86.	Professional Air Blower	Power consumption: 820 W, No-load speed: 16000rpm, Flow rate: 0-4.5 m3/s	10 Nos.

87.	Jig Saw Portable	Input Power: 900W, No-load speed: 11,000 rpm, Disc Diameter: 100	10 Nos.
88.	Hammer Drill Wired	Drill type: hammer, optimum power transfer	10 Nos.
89.	Hand Held Sander / Polisher	No Load Speed: 11000 rpm	10 Nos.
90.	Digital Dial Torque Wrench	Range: 20 to 280 Nm	10 Nos.
91.	Lifting Tackle/Sling	1 Ton×2mtr	10 Nos.
92.	Impact Wrench	1/2 inch drive	10 Nos.
93.	Laser Light Pen	---	10 Nos.
94.	Surface Plate	Cast iron	01 No.
95.	Digital Screw Pitch Gauge	Working voltage: 3.0 V / DC, Measure precision: 0.1 degree	05 Nos.
96.	Laser Distance Measurement Instrument	Levelling Accuracy (Vial): +/- 0.2degree, Measuring Accuracy Typical: +/- 1/16 inch (1.5mm)	05 Nos.
97.	Palm Scale	Capacity-500gms, Least Count-0.1g	05 Nos.
98.	Allen Screwdriver Wrench Tool	6Pcs T Handle Ball Ended Hex Key	05 Nos.
99.	Universal Quick Adjustable Multi-function Wrench Spanner	Range: 6-32mm	05 Nos.
100.	Double Ended Wrench Hex Socket Spanner	8 In 1, Range: 6-32mm	05 Nos.

ABBREVIATIONS:

CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Craft Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprenticeship Certificate
NCIC	National Craft Instructor Certificate
LD	Locomotor Disability
CP	Cerebral Palsy
MD	Multiple Disabilities
LV	Low Vision
HH	Hard of Hearing
ID	Intellectual Disabilities
LC	Leprosy Cured
SLD	Specific Learning Disabilities
DW	Dwarfism
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities