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

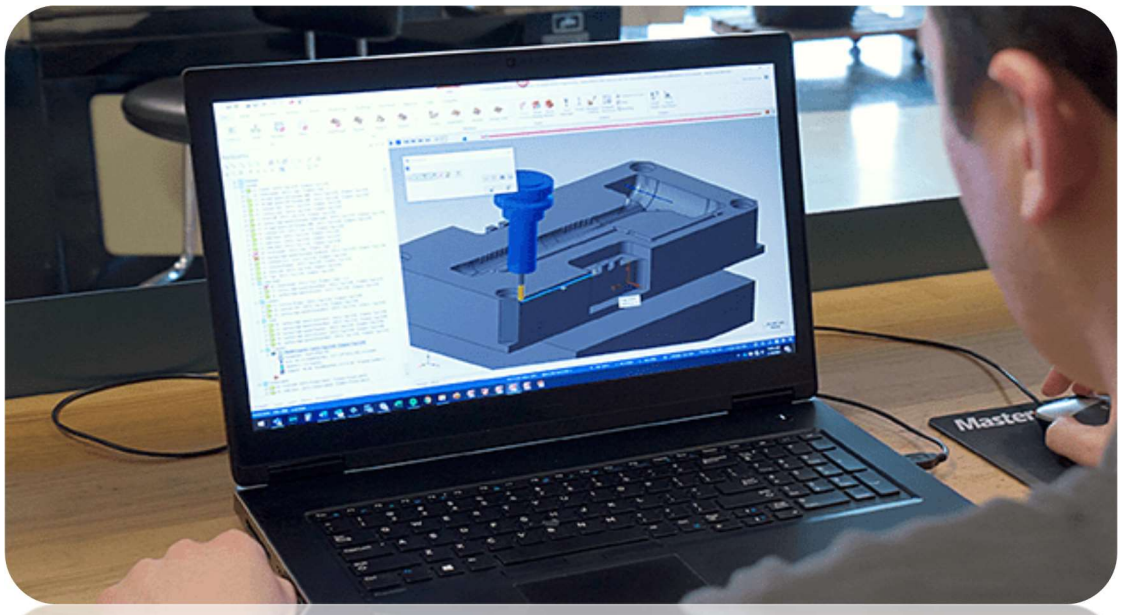
COMPETENCY BASED CURRICULUM

COMPUTER AIDED MANUFACTURING (CAM) PROGRAMMER

(Duration: One Year)

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL- 3.5



SECTOR –CAPITAL GOODS & MANUFACTURING

Directorate General of Training

COMPUTER AIDED MANUFACTURING (CAM) PROGRAMMER

(Engineering Trade)

(Designed in 2023)

Version: 1.0

CRAFTSMEN TRAINING SCHEME (CTS)

NSQF LEVEL – 3.5

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE

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1. COURSE INFORMATION

During the one-year duration of Computer Aided Manufacturing (CAM) Programmer trade, a candidate is trained on professional Skill, professional Knowledge and Employability Skill related to job role. In addition to this a candidate is entrusted to undertake project work and extracurricular activities to build up confidence.

CNC Machines and Computer-Aided Manufacturing software are both integral components in modern manufacturing processes, but they serve different functions.

The student will gain practical knowledge about safety and environment, use of fire extinguishers, artificial respirator resuscitation to begin. Students should gain a solid understanding of the principles and concepts, operation, and programming of CAM. They will learn different modules within Computer Aided Manufacturing tool including generating part program in CAM software modules like CNC Lathe programming, CNC Milling. Students will be able to learn effective integration of CAM software with CNC Machines, including process planning, workflow, CAM Program verification, CAM Program simulation and configuring post-processors. Students will also be able to learn about emerging trends in Computer Aided Manufacturing.

- Identify the component to be machined.
- Prepare machine plan and relevant CAD model and drawings.
- Import CAD Geometry in CAM software.
- Reduce cycle time, improve productivity, and perform necessary calculation to work on cost effective machining.
- Define Programming strategy and select Tool, speed, depth of cut and feed parameters
- Generate CAM Program and strategy iteration
- Model analysis for machining feasibility study
- Work on stock set up, work on single chain, continuous chain machining.
- CAM programing using features such as flow lines, waterlines, raster milling, spiral milling.
- Verify and validate the CAM Program to detect errors or collisions.
- Configure and customize post-processors to convert the tool paths into machine-specific instructions.
- Work on Advanced CAM software tools features such as Art Mode, Mesh editing, 3d model into bounding box, Contour, raster to vector CAM Programming.
- CAM Programming of complex parts using CAM software.
- Generate CAM program layout, tool path simulation.
- Maintain documentation of programming and machining processes, including setup sheets tooling information and work instructions.

- Work closely with quality control teams to ensure that the machined parts meet the required specifications and quality standards.
- Collaborate with designers, programmers, and machine operators to improve productivity.

2. TRAINING SYSTEM

2.1 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 economy/ Labour market. The vocational training programmes are delivered under the aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) with variants and Apprenticeship Training Scheme (ATS) are two pioneer schemes of DGT for strengthening vocational training.

Computer Aided Manufacturing (CAM) Programmer trade under CTS is one of the newly designed courses which will be delivered nationwide through a network of ITIs. The course is of one-year 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) impart requisite core skill, knowledge and life skills. After passing out 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 and interpret technical parameters/ documentation, plan and organize work processes, identify necessary materials and tools.
- Perform tasks with due consideration to safety rules, accident prevention regulations and environmental protection stipulations.
- Apply professional knowledge & employability skills while performing the job and modification & maintenance work.
- Check the task/job for functioning, identify and rectify errors in task/job.
- Document the technical parameter related to the task undertaken.

2.2 PROGRESSION PATHWAYS

- Can join industry as Computer Aided Manufacturing (CAM) Programmer and will progress further as Senior Computer Aided Manufacturing Programmer, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- Can join Apprenticeship Programmers in different types of industries leading to gain a National Apprenticeship Certificate (NAC).
- Can join Craftsman Instructor Training Scheme (CITS) in the trade for becoming an 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 one year:

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	840
2	Professional Knowledge (Trade Theory)	240
3	Employability Skills	120
	Total	**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
Optional Courses (10th/ 12th class certificate along with ITI certification or add on short term courses)	240

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 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. The marks of internal assessment will be as per the formative assessment template provided on www.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 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitivity to 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 examination body. The following marking pattern to be adopted for formative assessment:

Performance Level	Evidence
(a) Marksin the range of 60 -75% to be allotted during assessment	

For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	• 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/set standards. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b)Marksin the range of above75% - 90% to be allotted during assessment	
For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.	• 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/set standards. • A good level of neatness and consistency in the finish • Little support in completing the project/job
(c) Marksin the range of above 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/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief description of Job roles:

CAM programming has diverse applications across various industries that rely on CNC machining for their manufacturing processes. The aerospace and aviation industry benefit from CAM programming for producing intricate components like turbine blades and engine parts. In the automotive sector, CAM programming is essential for manufacturing engine blocks, transmission components, and molds for vehicle body panels. The medical industry utilizes CAM programming to create medical devices, implants, and surgical instruments with high precision. Mill 3D CAM Program & Die Machining, 3D Mill Mold cavity making industries rely on CAM programming to manufacture molds for plastic injection, die casting, and stamping operations. CAM programming is also employed in the electronics industry for precise routing and drilling of PCBs. Energy and power generation sectors utilize CAM programming to produce components for power plants and turbines. Tool and die manufacturing, furniture, and woodworking industries also benefit from CAM programming for their specific needs. It is therefore no doubt that CAM programming plays a vital role in various industries that require CNC machining to produce complex, precise, and customized components.

The job role in CAM Technician involves leveraging cutting edge technology within manufacturing processes and able to generate precise tool path, simulating machining strategies and ensuring efficient utilization of resources. In addition, this role entails collaborating with cross-functional teams, including engineers and technicians, to translate design specifications into practical manufacturing strategies. With a strong grasp of CAM software and a passion for innovation, that will contribute to driving the success of manufacturing operation.

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.

Computer Programmers, Other; are computer programmers who write, test and maintain computer programs to meet the needs of users of computer systems and all other Computer Programmers not elsewhere classified

Reference NCO-2015:

(i) 7223.6003
(ii) 2514.9900

Reference NOS: -

I. CSC/N9561,
II. CSC/N9401,
III. CSC/N9402,
IV. CSC/N9562,
V. CSC/N9563,
VI. CSC/N9564,
VII. CSC/N9565,
VIII. CSC/N9566,
IX. CSC/N9567,
X. CSC/N9568,
XI. CSC/N9569,
XII. CSC/N9570,
XIII. CSC/N9571,
XIV. CSC/N9572,
XV. CSC/N9573,
XVI. CSC/N9574,
XVII. CSC/N9575

4. GENERAL INFORMATION

Name of the Trade	**COMPUTER AIDED MANUFACTURING (CAM) PROGRAMMER**
NCO - 2015	7223.6003, 2514.9900
NOS Covered	CSC/N9561, CSC/N9401, CSC/N9402, CSC/N9562, CSC/N9563, CSC/N9564, CSC/N9565, CSC/N9566, CSC/N9567, CSC/N9568, CSC/N9569, CSC/N9570, CSC/N9571, CSC/N9572, CSC/N9573, CSC/N9574, CSC/N9575
NSQF Level	Level-3.5
Duration of Craftsmen Training	One year (1200 hours + 150 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, LV, DEAF, AUTISM, MD
Unit Strength (No. Of Student)	20 (There is no separate provision of supernumerary seats)
Space Norms	120 Sq. m
Power Norms	3 KW
Instructors Qualification for	
1. Computer Aided Manufacturing (CAM) Programmer Trade	B.Voc/Degree in Mechanical/Industrial Engineering from AICTE/UGC recognized Engineering College/university with one-year experience in the relevant field. **OR** 03 years Diploma in Mechanical/Industrial 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 "Computer Aided Manufacturing (CAM) Programmer" trade 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. *Faculty to be trained for 10 days by the machine manufacturer on the usages of the CAM software.***
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 Coursein Employability Skills.
5. Minimum Age for Instructor	21 Years
List of Tools and Equipment	As per Annexure – I

5. LEARNING OUTCOME

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:

1. Comply with the safe working practices, environmental regulation and housekeeping. (NOS: CSC/N9561)
2. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)
3. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (CSC/N9402)
4. Demonstrate the geometric dimensions, tolerances, and symbols used industrial manufacturing drawing and CAD models. (NOS: CSC/N9562)
5. Explain machining processes, machine selection, machining parameters like speed, feed, depth of cut also able to calculate cycle time and productivity and cost-effective machining. (NOS: CSC/N9563)
6. Implement basics of G codes and M codes used in CNC machines and importance of CAM with its user interface. (NOS: CSC/N9564)
7. Identify cutting tool assembly builder, CAM tooling library to create new, edit and modifying library data also create 2D sketches, 3D models and surface using point data and perform engraving on a curved surface and check draft angle for 3D Model by using CAM software for turning. (NOS: CSC/N9565)
8. Demonstrate Importing of CAD models in CAM software and edit / modify and perform transformation of CAD model. (NOS: CSC/N9566)
9. Execute set up work piece / component in the holding device and select tools and tool holders as per machining operation; also import, locate, and quickly re-use fixtures in CAM software. (NOS: CSC/N9567)
10. Demonstrate the concept of stock definition, stock set up and Handle Stock Models and Operations & work on 3D roughing and finishing operations and execute work on CAM programming using features such as flow lines, waterlines, raster milling, spiral and milling. (NOS: CSC/N9568)
11. Generate CAM Programs and verify, validate the CAM Program to detect errors or collisions and post process to specific CNC Machine for specific CNC Machine controller. (NOS: CSC/N9569)
12. Optimize CNC machining tool path, verify CAM program on CNC Simulator. (NOS: CSC/N9570)

13. Implement rework operation by selecting individual sub programs and generate CAM program layout, tool path simulation, and create hole table report in CAM software with coordinates. (NOS: CSC/N9571)
14. Demonstrate use of advanced CAM software tools such as: Art Mode, 3d model into bounding box, Contour, raster to vector CAM Programming, work with tool entry motion and Chain selection method, CAM software workflows, Silhouette boundary, Dynamic motion, Accelerated Finishing machine. (NOS: CSC/N9572)
15. Perform complex CAM programming for high precision aerospace components, Healthcare (medical equipment, implants, surgical instruments), Electronic applications such as PCB drilling and routing. Perform Mill 3D Blend & Scallop Finish, Mill 3D CAM Program, 3D Mill Mold cavity, generate negative impression of Die, Molds for plastic injection, die casting, and stamping operations etc. (NOS: CSC/N9573)
16. Interact with CNC operator and quality department to take corrective measures to meet the customer quality requirements, related documents and maintaining the documents with its retention techniques. (NOS: CSC/N9574)
17. Implement CAM software skills to become an entrepreneur to support industries and create more jobs. (NOS: CSC/N9575)

6. ASSESSMENT CRITERIA

LEARNING OUTCOMES	ASSESSMENT CRITERIA
1. Comply with the safe working practices, environmental regulation and housekeeping. (NOS: CSC/N9561)	Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	Recognize and report all unsafe situations according to site policy.
	Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	Identify, handle and store / dispose of. dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	Identify and observe site policies and procedures in regard to illness or accident.
	Identify safety alarms accurately.
	Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	Identify and observe site evacuation procedures according to site policy.
	Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	Identify basic first aid and use them under different circumstances
	Identify different fire extinguisher and use the same as per requirement.
	Identify environmental pollution & contribute to avoidance of same.
	Take opportunities to use energy and materials in an environmentally friendly manner.
	Avoid waste and dispose waste as per procedure.
	Recognize different components of 5S and apply the same in the working environment.
2. 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.
3. 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.
4. Demonstrate the geometric dimensions, tolerances, and symbols used industrial manufacturing drawing and CAD models. (NOS: CSC/N9562)	Interpret the various symbols, dimensions, and annotations present in the drawing, list out the intended meaning and purpose.
	Demonstrate the geometric shapes, features, and relationships depicted in the drawing, such as lines, arcs, circles, angles, and their corresponding measurements.
	Analyze the impact of tolerances on the functionality and fit of the components or parts.
5. Explain machining processes, machine selection, machining parameters like speed, feed, depth of cut also able to calculate cycle time and productivity and cost-effective machining. (NOS: CSC/N9563)	Select cutting tools and machine selection based on the machining operation, material.
	Define machining Parameter such as cutting speed, feed rate, depth of cut, and based on the machining operation, material.
	Calculating cycle time and productivity.
	Perform cost effective machining based on case study.
6. Implement basics of G codes and M codes used in CNC machines and importance of CAM with its user interface. (NOS: CSC/N9564)	Interpret purpose and function of various G codes and M codes.
	Demonstrating the ability to identify and troubleshoot issues related to G codes and M codes, such as incorrect syntax, incompatible codes, or programming errors.
	Make a list of benefits of CAM software.
7. Identify cutting tool assembly builder, CAM tooling library	Edit cutting tool data and cutting parameter.
	Modify the existing library tool data.

to create new, edit and modifying library data also create 2D sketches, 3D models and surface using point data and perform engraving on a curved surface and check draft angle for 3D Model by using CAM software for turning. (NOS: CSC/N9565)	Work on Cutting tool assembly builder.
	Create 2D sketches using appropriate tools and techniques within the CAM software such as lines, arcs, splines etc.
	Create 3D Model using the CAM software's.
	Engraving on curved surface.
	Create and define various features such as holes, pockets, fillets, chamfers, and threads within the 3D models.
	Demonstrate the ability to accurately import and align the point data within the CAM software.
8. Demonstrate Importing of CAD models in CAM software and edit / modify and perform transformation of CAD model. (NOS: CSC/N9566)	Import CAD models from various file formats commonly used in the industry.
	Make a transformation of cad model such as translation.
9. Set up of work piece / component in the holding device and select tools and tool holders as per machining operation; also import, locate, and quickly re-use fixtures in CAM software. (NOS: CSC/N9567)	Align the component accurately within the holding device, ensuring proper orientation and positioning.
	Select an appropriate holding fixture based on the component's shape, size, material, and machining requirements.
	Demonstrate and ensure adequate clearance between the component and the cutting tools or machine components to avoid collisions.
10. Demonstrate the concept of stock definition, stock set up and handle stock models and operations & work on 3D roughing and finishing operations and execute work on CAM programming using features such as flow lines, waterlines, raster milling and spiral milling. (NOS: CSC/N9568)	Demonstrating knowledge and understanding of stock definition, including its purpose, dimensions, and material considerations.
	Define initial stock geometry and determining the required stock shape and dimensions.
	Accurate placement and alignment of the stock within the holding device.
	Handle stock model and operation.
	Perform 3D roughing and finishing operations by using the CAM software.
	Execute the accuracy and precision of the generated toolpaths for 3D roughing and finishing operations.

	Demonstrate the achieved surface quality and finish in the 3D roughing and finishing operations.
11. Generate CAM Programs and post process to specific CNC Machine for specific CNC machine controller and verify and validate the CAM program to detect errors or collisions. (NOS: CSC/N9569)	Interpret CAM program and specify basic programming requirements.
	Implement effectively post-process of CAM programs to generate machine-specific code.
	Demonstrate the capability to detect and avoid potential collisions between the cutting tool, the work piece, and any machine components.
	Verify the tool path provides sufficient clearance for the cutting tool and work piece
	Generate CAM Programs that achieve the desired dimensional accuracy and tolerances as specified for the given component.
	Create the document for generated CAM Program, including cutting parameters, tooling selection.
12. Optimize CNC machining tool path, verify CAM program on CNC Simulator and customize post-processors to convert the toolpaths into machine-specific instructions. (NOS: CSC/N9570)	Export or transfer NC codes into the control panel or simulator.
	Operate the control panel by using simulator to create program.
	Optimize the tool change sequence and minimizing tool change times.
13. Implement rework operation by selecting individual sub programs and generate CAM program layout, tool path simulation, and create hole table report in CAM software with coordinates. (NOS: CSC/N9571)	Identify the rework operations and parameters.
	Create subprogram of necessary operation(s) using G code and M code.
	Identify the subprogram to perform rework operation.
	Generate CAM program layout
	Simulate the tool path and check for tool collision and make report of cycle time to complete the operation.
	Create hole table report in CAM software with coordinates.
14. Demonstrate use of advanced CAM software tools like art mode, 3d model	Make a CAM program using Art Mode feature and perform mesh editing tasks within the CAM software.
	Import 3D models and converting them into bounding boxes.

into bounding box, Contour, raster to vector CAM Programming, work with tool entry motion and chain selection method, CAM software workflows, Silhouette boundary, Dynamic motion, Accelerated Finishing machine. (NOS: CSC/N9572)	Convert raster images to vector-based CAM programming.
	Practice on CAM Software workflows.
	Generate the toolpath using Silhouette Boundary and Dynamic Motion, Accelerated Finishing Machining advanced tools.
	Use of Feature Extraction tool to identify and extract specific features from 3D models or geometries.
	Evaluate the understanding of different tool entry motions and their suitability for specific machining scenarios.
	Select appropriate chain selection method based on specific machining requirements.
15. Perform complex CAM programming for high precision aerospace components, Healthcare (medical equipment, implants, surgical instruments), Electronic applications such as PCB drilling and routing. Perform Mill 3D Blend & Scallop Finish, Mill 3D CAM Program, 3D Mill Mold cavity, generate negative impression of Die, molds for plastic injection, die casting, and stamping operations etc. (NOS: CSC/N9573)	Create complex CAM Programming: For aerospace components, healthcare/medical equipment, and other precision-driven applications.
	Create PCB drilling and routing using CAM software.
	Create Mill 3D CAM Program
	Create CAM program for 3D Mill Mold cavity.
	Suggest the ways to optimize workflows and improve overall efficiency in the programming and manufacturing processes.
	Create efficient Core-Cavity – mold machining.
	Create CAM Program for different components such as Die and molds and injection Molding.
16. Interact with CNC operator and quality department to take corrective measures to meet the customer quality requirements, related documents and maintaining the documents with its retention techniques. (NOS: CSC/N9574)	Identify the root causes and propose appropriate corrective actions to meet quality requirement.
	Identify the machining-related documents adhere to relevant industry standards, regulations, and quality requirements.
	Create machining-related documents, including process plans, work instructions, tooling lists, and inspection reports.
	Implementing a revision control system to track and manage changes made to machining-related documents.
	Interaction with operator to check quality and related inspection

	report.
17. Implement CAM software skills to become an entrepreneur to support industries and create more jobs. (NOS: CSC/N9575)	Identify potential opportunities for entrepreneurship related to CAM services.
	List the CAM services offerings.
	Identify unique selling proposition.
	Prepare business plan to start entrepreneurship related to CAM services.

7. TRADE SYLLABUS

SYLLABUS FOR COMPUTER AIDED MANUFACTURING PROGRAMMERTRADE			
DURATION: ONE YEAR			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 24 Hrs. Professional Knowledge 06 Hrs.	Comply with the safe working practices, environmental regulation and housekeeping.	1. Importance of trade training, List of tools & Machinery used in the trade. 2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE) such as use of gloves and goggles. 3. First Aid Method and basic training. 4. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. 5. Identify hazard to avoid accident. 6. Safety signs for Danger, Warning, caution & personal safety message. 7. Preventive measures for electrical accidents & steps to be taken in such accidents. 8. Use of Fire extinguishers. 9. Practice and understand precautions to be followed while working in fitting jobs. 10. Safe use of tools and equipment used in the	All necessary guidance to be provided to the newcomers 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.

		trade by using tweezers for all purposes and handle scrappers.	
ENGINEERING DRAWING			
Professional Knowledge ED -30 hrs.	Read and apply engineering drawing for different application in the field of work.	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 arrowheads • Leader line with text • Position of dimensioning (Unidirectional, Aligned) • Symbolic representation – • Different symbols used in the related trades. • Concept and reading of Drawing • 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 related to trades.	
WORKSHOP CALCULATION & SCIENCE			
Professional Knowledge WC- 30 Hrs	Demonstrate basic mathematical concept and principles to perform practical operations.	**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	

	Understand and explain basic science in the field of study.	• Fractions - Addition, subtraction, multiplication & division • Decimal fractions - Addition, subtraction, multiplication & division • Solving problems by using calculator • Square root, Ratio and Proportions, Percentage • Square and square root • Simple problems using calculator. • Applications of Pythagoras theorem and related problems **Ratio and proportion** • Ratio and proportion - Direct and indirect proportions **Percentage** • Percentage - Changing percentage to decimal and fraction **Material Science** • Types metals, types of ferrous and nonferrous metals • Introduction of iron and cast iron. • Mass, Weight, Volume and Density • Specific gravity • Speed and Velocity, Work, Power, and Energy • Speed and velocity - Rest, motion, speed, velocity, difference between speed and velocity, acceleration, and retardation • Speed and velocity - Related problems on speed & velocity • Work, power, energy, HP, IHP, BHP and efficiency **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 • Scales of temperature, Celsius, Fahrenheit, kelvin, and conversion between scales of temperature. **Basic Electricity** • Introduction and uses of electricity, electric current AC, DC their comparison, voltage, resistance, and their units. • Conductor, insulator, types of connections - series and parallel. • Ohm's law, relation between V.I.R & related problems. • Electrical power, energy and their units, calculation with assignments. • Magnetic induction, self and mutual inductance and EMF

		generation • Electrical power, HP, energy, and units of electrical energy **Trigonometry** • Measurement of angles • Trigonometrical ratios	
Professional Skill 50 Hrs. Professional Knowledge 10 Hrs.	Demonstrate the geometric dimensions, tolerances, and symbols used industrial manufacturing drawing and CAD models.	11. Identify and make a list of drawings, such as assembly drawings, part drawings, and detail drawings. 12. Practice on dimensions, tolerances, symbols, and annotations present in the drawings and understand their meaning and significance. 13. Applying different dimensioning techniques, such as linear dimensions, angular dimensions, and geometric tolerances, based on the requirements of the drawing as per case study. 14. Perform tolerance analysis exercises to understand how tolerances are applied in manufacturing drawings. 15. Study the impact of different tolerance values on the fit, functionality, and manufacturability as per case study. 16. Create and interpreting section views in manufacturing drawings. Understand how to represent internal features, hidden details, and	Introduction to industrial detail drawing. Drawing standards and conventions. Geometric dimensioning and tolerances (GD & T) Symbols, abbreviations, line types, and drawing layout formats, such as ANSI, ISO, or ASME standards.

		complex geometries through section views and how they aid in understanding the design and manufacturing requirements. 17. Assign the dimensioning components based on given tolerances. Choose various geometric features, such as holes, shafts, or surfaces, and apply appropriate tolerances based on the functional requirements and manufacturing capabilities. 18. Perform tolerance stack-up analysis on assemblies or sub-assemblies. 19. Apply GD&T symbols on given industrial manufacturing drawing. 20. Identify and make a list of types fits in assembly.	
Professional Skill 24 Hrs. Professional Knowledge 06 Hrs.	Explain machining processes, machine selection, machining parameters like speed, feed, depth of cut also able to calculate cycle time and productivity and cost-effective machining.	21. Define the machining process as per industrial case study. 22. Modify machining parameters, tool geometries, or machining strategies to enhance productivity, surface finish, or tool life. 23. Calculate cycle time of machining as per case study data. 24. Calculate total time as per case study data.	Introduction to turning and milling operations. Types of tooling. Types of tool holder. Impact of machining parameters like speed, feed, and depth of cut. Impact on surface finish, and dimensional tolerances. Tools Cutting parameters, Tool geometry and tool wear. Importance of work piece material on tool selection. Concept of cycle time, Tact time, Lead time.

		25. Calculate the lead time as per case study data. 26. Calculate the productivity as per case study.	Comparing cycle time vs Tact time vs lead time. Case study and Importance of calculation in industry. Concept of productivity. Industrial case study for machining shop. List out the turning machine operation. List out the milling machine operation.
Professional Skill 50 Hrs. Professional Knowledge 10 Hrs.	Implement basics of G codes and M codes used in CNC machines and importance of CAM with its user interface.	27. Manually create an CNC Turning program as per case study provided machining drawing. 28. Manually create an CNC milling program as per case study provided machining drawing. 29. As per case study data analyse error messages or unexpected machine behaviour, identify the source of the problem, and rectify the issues by adjusting the G code or M code commands. 30. Use the function of CAM Menu bar (File, Edit, View, etc.) 31. Draw a layout and checklist of user interface. 32. Perform basic setting and toolbar orientation for CAM software.	CNC Codes are commands used to control the movement and functions of a CNC machine. M Code and its applicability. G Code and its functionality. List out the M code with its functions. List out the G code with its function List out the importance of machine parameters, tool offsets, work piece zero points, and coordinate systems Orientation of user interface (UI) of cam software. Understand Uses of Menu bar (File, Edit, View, etc.) Operation manger, toolpath manager, plan manager, Status bar, graphic window. Make a list of CAM software benefits. Industrial case study for CNC turning operation. Industrial case study for milling machine operation.
Professional Skill 100 Hrs.	Identify cutting tool assembly builder,	33. Create a new tool and upload to library.	Operation in a tool library.

Professional Knowledge 20 Hrs.	CAM tooling library to create new, edit and modifying library data also create 2D sketches, 3D models and surface using point data and perform engraving on a curved surface and check draft angle for 3D Model by using CAM software for turning.	34. Edit cutting tool data and cutting parameter. 35. Modifying the existing library tool data. 36. Create tooling using Cutting Tool assembly builder. 37. Launch CAM software: Open CAM software and start a new project or select an existing one. 38. Create 2D sketches of the part or feature to be machined. This can include basic geometrical shapes such as lines, arcs, circles, rectangles, or more complex shapes. 39. Editing and modifying 2D sketch. 40. Revolving 2D Sketch, 41. Extruding the 2D sketch. 42. Create a 3D model in CAM Software. 43. Modifying 3D models by using the CAM software, 44. Check draft angle using CAM software tools. 45. Create the 3D surface using basic point data. 46. Perform engraving on a curved surface through advance tooling in cam software.	Concept about tool selection turning right hand tools, left hand tools. Tool file import in a CAM. Concept tooling assembly builder in cam software. Orientation of cam software sketcher toolbar. Plane selection and its importance. 2D Sketch concept in cam software. Orientation of 3D modelling toolbar CAM software. Concept of draft angle inspection using cam software. Creating a 3D surface using CAM, quality checks ensure the final 3D surface aligns with specifications. Concept of engraving on a curved surface.
Professional Skill 50 Hrs. Professional Knowledge	Demonstrate Importing of CAD models in CAM software and edit / modify and perform	47. Keep or save 3D model in specific folder. 48. List out the Supported file formats. 49. Verify the file formats	Concept of utilizing transformation tools such as translation, rotation, scaling, and mirroring, adjust dimensions, create symmetrical features, or

10 Hrs.	transformation of CAD model.	supported by CAM software for importing CAD model, 50. Create or open a new or existing project in CAM software. 51. Import CAD model: Choose the appropriate file format for CAD model and select the file to import. 52. Setting up model orientation: rotate, translate, or scale the model as needed in cam software. 53. Model verification: Review the imported CAD model to ensure it matches the desired part. 54. Transform the geometry for individual objects, groups, or entire assemblies. 55. Translate and move the selected geometry along specified directions or distances. 56. Using rotation tool to rotate the selected geometry around specified axes or pivot points. This enables to change the orientation or alignment of the CAD model to suit the desired design or assembly requirements. 57. Use the scaling tool to resize the selected geometry uniformly or	optimize the overall design.

		along specific axes. 58. Review the modified CAD model using the software's visualization tools.	
Professional Skill 50 Hrs. Professional Knowledge 10 Hrs.	Execute set up work piece / component in the holding device and select tools and tool holders as per machining operation; also import, locate, and quickly re-use fixtures in CAM software.	59. Identify and make a list of the appropriate holding device for the specific component want to set up. 60. Determine the optimal orientation and positioning of the work piece within the holding device. Consider factors such as access to machining features, tool clearance, and the desired final part orientation. 61. Align the work piece position within the holding device as per tooling direction and machine's coordinate system. 62. Identify and make a list of the machining operations needed, such as turning, milling, drilling. 63. Make a list of selection of tool according to material properties, such as hardness, toughness, and heat resistance. 64. Calculate the tool life based on industrial case study. 65. Import, locate, and quickly re-use fixtures in CAM software.	Concept of holding devices, tool clearance and access to machining features. Importance of workpiece and tool material properties, tool life calculations. Tool selection criteria. Impact of cutting parameters, cost analysis. Concept of Import, locate, and quickly re-use fixtures in CAM software.
Professional Skill 50 Hrs.	Demonstrate the concept of stock	66. Define the stock dimension as per application based on	Practical steps for stock definition and set up include

Professional Knowledge 10 Hrs.	definition, stock set up and Handle Stock Models and Operations & work on 3D roughing and finishing operations and execute work on CAM programming using features such as flow lines, waterlines, raster milling, spiral and milling.	operation add the stock on sample cad model. 67. Add stock material on cad model as per work holding and Fixture. 68. Handle stock model operation using advance cam tool. 69. Optimize machining parameters for 3D roughing and finishing. 70. Effectively apply and utilize the features of flow lines, waterlines, raster milling, and spiral milling. 71. Define toolpaths along flow lines, waterlines, or raster patterns.	selecting the appropriate material, Concept of handle stock model in advanced cam tool. Concept of roughing and finishing operation. Various strategies to achieve efficient material removal during roughing operations. Benefits of roughing operation. CAM programming using features like flow lines, waterlines, raster milling, and spiral milling, several criteria can be considered.
Professional Skill 50 Hrs. Professional Knowledge 10 Hrs.	Generate CAM Programs and verify, validate the CAM Program to detect errors or collisions and post process to specific CNC Machine for specific CNC Machine controller.	72. Check for any potential collisions between the tool, work piece, clamps, or fixtures in the simulation. 73. Make a List of the different types of CNC machine controllers. 74. Assess proficiency in using CAM software with various CNC machine controllers. 75. Generate machine specific code in post-processing using CAM programs.	Orientation of different controllers, proficiency in CAM software usage, accuracy of generated programs, post-processing abilities, and problem-solving skills. Concept of Error-free CAM programs, and post-process them for specific machine controllers. Validate the CAM Program to detect errors or collisions
Professional Skill 50 Hrs. Professional Knowledge 10 Hrs.	Optimize CNC machining tool path, verify CAM program on CNC Simulator.	76. Create a program on CNC Simulator to understand G code and M code. 77. Run simulations of CNC programs on the simulator 78. Simulators can simulate common errors.	Orientation of different controllers, proficiency in CAM software usage, accuracy of generated programs, post-processing abilities. Different technologies &processes of CAM: -

		79. Optimize the Tool Path: Optimization tools to refine and optimize the tool path.	Using 3d tool path & generate. Convert the toolpaths into machine-specific instructions.
Professional Skill 50 Hrs. Professional Knowledge 10 Hrs.	Implement rework operation by selecting individual sub programs and generate CAM program layout, tool path simulation, and create hole table report in CAM software with coordinates.	80. Identify the component is ok, rework or reject. 81. Identify of rework requirements and select appropriate individual subprograms. 82. Generate the toolpath for pocket milling operation and simulation. 83. Posting individual or selected operation toolpath. 84. Edit the generated NC code and save file to defined folder. 85. Create 2D toolpath for different operation of milling machine such as Contouring, Pocketing, Drilling, 86. Create hole table report in CAM software with coordinates	Concept of in process inspection of component. Identifying and tagging for Ok, Rework and reject components and its importance. Identify the work piece is in reject stage or opportunity to rework. subprogram selection. Concept of Post toolpath. Process involves in Post tool path operation. Selection criteria of NC File format. Concept of editing generated NC code. Sending NC Files to the machine. Concept of creation hole table report in CAM software with coordinates.
Professional Skill 100 Hrs. Professional Knowledge 20 Hrs.	Demonstrate use of advanced CAM software tools such as: Art Mode, 3d model into bounding box, Contour, raster to vector CAM Programming, work with tool entry motion and Chain selection method, CAM software	87. Make a program by using art mode feature within the CAM software. 88. Import 3D models and defining bounding box. 89. Proficiency in contouring 90. Converting raster images into vector-based CAM programming. 91. Make a program using Silhouette Boundary, Dynamic Motion	Concept and orientation of Art Mode. Concept of 3d model into bounding box Concept of Contour, raster to vector CAM Programming. Importance of CAM software workflows. Concept of toolpath generation parameter effects such as entry points, stopovers, and cutting

	workflows, Silhouette boundary, Dynamic motion, Accelerated Finishing machine.	Machining, and Feature Extraction. 92. Change the tool's entry motion based on the specific properties of the material being machined. 93. Identify collision and modify the CAM program to avoid toolpath collisions during the entry motion process. 94. Make a report on single chain and continuous chain advanced CAM tool. 95. Generate toolpaths using the selected chain selection method.	strategies, on the overall machining performance. Methods of chain selection and its types.
Professional Skill 100 Hrs. Professional Knowledge 20 Hrs.	Perform complex CAM programming for high precision aerospace components, Healthcare (medical equipment, implants, surgical instruments), Electronic applications such as PCB drilling and routing. Perform Mill 3D Blend & Scallop Finish, Mill 3D CAM Program, 3D Mill Mold cavity, generate negative impression of Die, Molds for plastic injection, die casting,	96. Create a CAM programming tasks for complex aerospace components, healthcare implants, and surgical instruments. 97. Create a program on electronic applications using CAM software for electronic applications, particularly PCB drilling and routing. 98. Create a CAM program using advanced feature of die Machining, 3D Mill mould cavity Moulds for plastic injection, die casting, stamping operations. 99. Create a CAM program using advanced feature of cavity manufacturing.	Concept of Complex CAM programming for aerospace components, Healthcare / medical equipment like implants, and surgical instruments with high precision. Concept of generating CAM program for electronic applications. Challenges in generating CAM program for Mill 3D CAM Program Types of different Dies and its machining criteria. 3D Mill mould cavity machining criteria and its significant parameters. Concept of negative impression of Die, Moulds for plastic injection machine. Machining criteria for die casting components. Industrial case studies.

	and stamping operations etc.	100. Create efficient core cavity Mould machining using advanced CAM feature.	
Professional Skill 50 Hrs. Professional Knowledge 10 Hrs.	Interact with CNC operator and quality department to take corrective measures to meet the customer quality requirements, related documents and maintaining the documents with its retention techniques.	101. Make a check list of machine operator inspection parameter. (Operator parameter) 102. Make an in-process inspection report format and identify quality checking parameters. 103. Inspect and identify the component. 104. Select individual operation program for rework operation. 105. Perform Industry mini project as per case study. 106. Make a check list of tooling used for CAM programming. Make a process parameter sheet for operation in terms of speed, feed, and depth of cut.	Concept of Tagging OK, Rework and reject. Concept of quality control and quality assurance. Industry case study. Standard operating procedure for machine operator.
Professional Skill 42 Hrs. Professional Knowledge 18 Hrs.	Implement CAM software skills to become an entrepreneur to support industries and create more jobs.	107. Prepare market survey report to identify potential opportunities for entrepreneurship. 108. Draw a flow chart to start a small-scale company offering CAM services. 109. Prepare a brochure to promote CAM services. 110. Prepare a business plan. 111. Identify Key matrices for managing company.	Innovation, Importance of Innovation, how to start a small-scale company offering CAM services, how to manage operations, potential opportunities for entrepreneurship etc.
In-plant training / Project work			

Project work involving "Application of CAM technology to enhance discreet machining efficiency in three domains – namely, Aerospace, Automotive, Manufacturing and Medical" using real world components.
Note: *The duration of Professional skills (Trade practical) and Professional knowledge (Trade theory) are indicative only. The Training Institute has the flexibility to adopt suitable training duration for effective training.*

SYLLABUS FOR CORE SKILLS
1. Employability Skills (Common for all CTS trades) (120 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/ www.dgt.gov.in

ANNEXURE-I

LIST OF TOOLS AND EQUIPMENT			
COMPUTER AIDED MANUFACTURING (CAM) PROGRAMMER (For batch of 20 Candidates) + 1 instructor			
S No.	**Name of the Tool &Equipment**	**Specification**	**Quantity**
A. GENERAL MACHINERY / SOFTWARE INSTALLATIONS			
1.	Industrial Workstation.	32 GB RAM, 1 TB 7200 RPM SATA HDD, 256 GBPCIe SSD Class 40, NVIDIA Qdr P1000 4GB, Win 10 Pro, Intel Xeon-2213 USB Keyboard & USB Optical Mouse Or equivalent	20+1 Nos.
2.	Monitor	P2219H Pivot, Tilt, Swivel or adjust Height, Viewing angle of 178/178, Antiglare screen, Energy star compliance Or equivalent	20+1 Nos.
3.	Server with rack	4214R 2.4GHz, 12C/24T,16.5M Cache, 32GB*4 RDIMM, 3200 MT/a 600GB x 5nos. 10K RPM SAS 12Gbps 2.5in Hot plug HDD (latest updated one) 15U Rack Or equivalent	1 No.
4.	UPS	5 KVA With Battery & Trolley	1 No.
5.	Computer Aided Manufacturing software	---	20+1 Nos.
6.	CNC SIMULATOR	NC Control Identical simulator(milling/turning)	3 Nos.
7.	Network infrastructure	LAN connectivity between system less than 10 ms latency	
8.	LED Projector with screen		1 Set
9.	Printer	A3	01 No
10.	Furniture to be added as per workstations. And simulators		

ANNEXURE - II

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts, trainers of ITIs, NSTIs, faculties from universities and all others who contributed in revising the curriculum.

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

List of Expert members participated for finalizing the course curriculum of Computer Aided Manufacturing (CAM) Programmer Trade at NIMI Chennai on 28.08.2023.

S No.	Name & Designation Sh/Mr/Ms	Organization	Remarks
1.	Anil Kumar, Dy. Director General	RDSDE, Chennai	Chairman
2.	S Muthumukar, Manager (Service)	MTAB Engineer's Pvt. Ltd.	Member
3.	H K Madhu	Alined Technologies	Member
4.	Daniel Raravi	Mastercam India	Member
5.	Dr. Ishtiaq Khan	TATA Technologies	Member
6.	A Vijayaraghavan, Rtd. Employee	ATI Chennai	Member
7.	Manu Kumar H A	NSTI Chennai	Member
8.	Chandiramohan D		Member
9.	Pradeep S	TATA Technologies	Member
10.	K Naga Srinivas, Dy. Director (Retd.)	NSTI, Hyderabad	Member
11.	K Mahendar, Jt. Director (Retd.)	RDSDE	Member
12.	S Soundaravelu	SIEMENS Ltd.	Member
13.	K Srinivasa Rao	NIMI, Chennai	Member
14.	T V Rajasekar	NIMI, Chennai	Member
15.	N Manoharan	Govt. ITI	Member
16.	Akhilesh Pandey, Asst. Director	CSTARI	Member
17.	K V S Narayana, Training Officer	CSTARI	Member
18.	Anandh Kumar S	SIEMENS Ltd.	Member
19.	S Vijayakumar	Kiseki Machinery	Member
20.	Hemaprabhan N	Lakshmi Machine Works Ltd.	Member
21.	Gopalakrishnan V, Manager	NIMI, Chennai	Member
22.	Nirmalya Nath, Dy. Director	NIMI, Chennai	Member

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


कौशलं बलम्