Model Curriculum

QP Name: CNC Programmer

QP Code: CSC/Q0401

Version: 2.0

NSQF Level: 5

Model Curriculum Version: 1.0

Capital Goods Skill Council || Awfice Space Solutions Pvt. Ltd, 1st Floor, L-29, Outer Circle, Connaught Place, New Delhi – 110001

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Training Parameters

Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods
Occupation	Design
Country	India
NSQF Level	5
Aligned to NCO/ISCO/ISIC Code	NCO-2015/ NIL
Minimum Educational Qualification and Experience	Graduation in relevant field OR 3 Year Diploma (After 10th) in the relevant field with 2 years of experience in the relevant field OR 10th + ITI (2 years) in the relevant field with 3 years of relevant experience in the relevant field OR Certified in NSQF-L4 Draughtsman - Mechanical with 2 years of experience in the relevant field
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 Years
Last Reviewed On	NA
Next Review Date	NA
NSQC Approval Date	NA
QP Version	2.0
Model Curriculum Creation Date	NA
Model Curriculum Valid Up to Date	NA
Model Curriculum Version	1.0
Minimum Duration of the Course	480 Hours
Maximum Duration of the Course	480 Hours

Program Overview

This section summarizes the end objectives of the program along with its duration.

Training Outcomes

At the end of the program, the learner should have acquired the listed knowledge and skills to:

- Explain the importance of following the health and safety practices at work.
- Demonstrate ways to coordinate with co-workers to achieve work efficiency.
- Demonstrate the process of programing Computer Numerically Controlled (CNC) machines.
- Describe the process of assisting in process improvements and machine maintenance.

Compulsory Modules

The table lists the modules and their duration corresponding to the Compulsory NOS of the QP.

NOS and Module Details	Theory Duration	Practical Duration	On-the-Job Training Duration (Mandatory)	On-the-Job Training Duration (Recommended)	Total Duration
Bridge Module	**04:00**	**00:00**	**0:00**	**00:00**	**04:00**
Module 1: Introduction to the role of a CNC Programmer	04:00	0:00	0:00	00:00	04:00
CSC/N1335 Follow the health and safety practices at work **NOS Version- 2.0** **NSQF Level- 3**	**20:00**	**60:00**	**0:00**	**00:00**	**80:00**
Module 2: Health and safety practices	20:00	60:00	0:00	00:00	80:00
CSC/N1336 Coordinate with co-workers to achieve work efficiency **NOS Version-2.0** **NSQF Level- 3**	**20:00**	**60:00**	**0:00**	**00:00**	**80:00**
Module 3: Process of coordinating with co-workers to achieve work efficiency	20:00	60:00	0:00	00:00	80:00
CSC/N0401 Program Computer Numerically Controlled (CNC) machines **NOS Version- 2.0** **NSQF Level- 5**	**40:00**	**106:00**	**0:00**	**00:00**	**146:00**

Module 4: Process of programming Computer Numerically Controlled (CNC) machines	40:00	106:00	0:00	00:00	146:00
CSC/NXXXX Assist in process improvements and machine maintenance **NOS Version- 1.0** **NSQF Level- 5**	**66:00**	**104:00**	**0:00**	**00:00**	**170:00**
Module 5: Process of Assist in process improvements and machine maintenance	66:00	104:00	0:00	00:00	170:00
Total Duration	**150:00**	**330:00**	**0:00**	**00:00**	**480:00**

Module Details

Module 1: Introduction to the role of a CNC Programmer

Bridge Module

Terminal Outcomes:

- Discuss the job role of a CNC Programmer.

Duration: 04:00	Duration: 0:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Describe the size and scope of the capital good industry and its sub-sectors. • Discuss the role and responsibilities of a CNC Programmer. • Identify various employment opportunities for a CNC Programmer.	
Classroom Aids	
Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films	
Tools, Equipment and Other Requirements	
NA	

Module 2: Health and safety Practices

Mapped to CSC/N1335 v2.0

Terminal Outcomes:

- Demonstrate ways to maintain personal health and safety.
- Describe the process of assisting in hazard management.
- Explain how to check the first aid box, firefighting and safety equipment.
- Describe the process of assisting in waste management.
- Explain the importance of following the fire safety guidelines.
- Explain the importance of following the emergency and first-aid procedures.
- Demonstrate the process of carrying out relevant documentation and review.

Duration: 20:00	**Duration: 60:00**
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain the recommended practices to be followed to ensure protection from infections and transmission to others, such as the use of hand sanitizer and face mask. • Explain the importance and process of checking the work conditions, assessing the potential health and safety risks, and take appropriate measures to mitigate them. • Explain the importance and process of selecting and using the appropriate PPE relevant to the task and work conditions. • Explain the recommended techniques to be followed while lifting and moving heavy objects to avoid injury. • Explain the importance of following the manufacturer's instructions and workplace safety guidelines while working on heavy machinery, tools and equipment. • Explain the importance and process of identifying existing and potential hazards at work. • Describe the process of assessing the potential risks and injuries associated with the various hazards. • Explain how to prevent or minimise different types of hazards. • Explain how to handle and store	• Demonstrate the use of appropriate Personal Protective Equipment (PPE) relevant to the task and work conditions. • Demonstrate how to handle hazardous materials safely. • Demonstrate the process of testing the firefighting and various safety equipment to ensure they are in usable condition. • Demonstrate the process of recycling and disposing different types of waste appropriately. • Demonstrate how to use the appropriate type of fire extinguisher to extinguish different types of fires safely. • Demonstrate how to administer appropriate first aid to the injured personnel. • Demonstrate the process of performing Cardiopulmonary Resuscitation (CPR) on a potential victim of cardiac arrest. • Demonstrate the process of carrying out appropriate documentation following a health and safety incident at work, including all the required information.

hazardous materials safely. • Explain the importance of ensuring the first aid box is updated with the relevant first aid supplies. • Describe the process of checking and testing the firefighting and various safety equipment to ensure they are in a usable condition. • Explain the criteria for segregating waste into appropriate categories. • Describe the appropriate methods for recycling the recyclable waste. • Describe the process of disposing of the non-recyclable waste safely and the applicable regulations. • Explain the use of different types of fire extinguishers to extinguish different types of fires. • State the recommended practices to be followed for a safe rescue during a fire emergency. • Explain how to request assistance from the fire department to extinguish a serious fire. • Explain the appropriate practices to be followed during workplace emergencies to ensure safety and minimise loss to organisational property. • State the common health and safety hazards present in a work environment, associated risks, and how to mitigate them. • State the safe working practices to be followed while working at various hazardous sites and using electrical equipment. • Explain the importance of ensuring easy access to firefighting and safety equipment. • Explain the appropriate preventative and remedial actions to be taken in the case of exposure to toxic materials, such as poisonous chemicals and gases. • Explain various causes of fire in	

different work environments and the recommended precautions to be taken to prevent fire accidents. • Describe different methods of extinguishing fire. • List different materials used for extinguishing fire. • Explain the applicable rescue techniques to be followed during a fire emergency. • Explain the importance of placing safety signs and instructions at strategic locations in a workplace and following them. • Explain different types of first aid treatment to be provided for different types of injuries. • State the potential injuries associated with incorrect manual handling. • Explain how to move an injured person safely. • State various hazards associated with the use of various machinery, tools, implements, equipment and materials. • Explain the importance of ensuring no obstruction and free access to fire exits. • Explain how to free a person from electrocution safely. • Explain how to administer appropriate first aid to an injured person. • Explain how to perform Cardiopulmonary Resuscitation (CPR). • Explain the importance of coordinating with the emergency services to request urgent medical assistance for persons requiring professional medical attention or hospitalisation. • State the appropriate documentation to be carried out following a health and safety incident at work, and the relevant information to be included.	

• Explain the importance and process of reviewing the health and safety conditions at work regularly or following an incident. • Explain the importance and process of implementing appropriate changes to improve the health and safety conditions at work.	
Classroom Aids	
Computer, Projection Equipment, PowerPoint Presentation and Software, Facilitator's Guide, Participant's Handbook.	
Tools, Equipment and Other Requirements	
Personal Protective Equipment, Cleaning Equipment and Materials, Sanitizer, Soap, Mask	

Module 3: Process of Coordinating with co-workers to achieve work efficiency

Mapped to NOS CSC/N1336 v2.0

Terminal Outcomes:

- Demonstrate ways to Work and communicate effectively with co-workers.
- Discuss ways to promote diversity and inclusion at the workplace.

Duration: 20:00	Duration: 60:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain the importance and process of effective communication in the workplace. • Explain the barriers to effective communication and how to overcome them. • Explain the importance of teamwork in an organisation's and individual's success. • Explain the importance of active listening in the work environment. • State the appropriate techniques to be followed for active listening. • Explain the importance of tone and pitch ineffective communication. • Explain the importance of avoiding casual expletives and unpleasant terms while communicating professional circles. • Explain the importance of maintaining discipline and ethical behaviour at work. • **State** the common reasons for interpersonal conflict and how to resolve them. • Explain the importance of developing effective working relationships for professional success. • Describe the process of expressing and addressing grievances appropriately and effectively. • Explain the importance and process of planning daily tasks to ensure their timely completion and efficient use of	• Demonstrate the process of preparing the relevant documents and reports as per the supervisor's instructions, providing appropriate information clearly and systematically. • Demonstrate how to mentor and assist subordinates in the execution of their work responsibilities. • Demonstrate the process of using various resources efficiently to ensure maximum utilisation and minimum wastage. • Demonstrate how to communicate clearly and politely to ensure effective communication with co-workers. • Demonstrate appropriate verbal and non-verbal communication that is respectful of genders and disability.

time. • Explain the importance of adhering to the limits of authority at work. • Explain the importance of following the applicable quality standards and timescales at work. • Explain the importance of coordinating with co-workers to achieve the work objectives efficiently. • Explain the relevant documentation requirements. • Explain the importance of providing appropriate information clearly and systematically in work documents. • State the escalation matrix to be followed to deal with out of authority tasks and concerns. • Explain the importance and process of mentoring and assisting subordinates in the execution of their work responsibilities. • Explain how to identify possible disruptions to work prevent them. • Explain how to use various resources efficiently to ensure maximum utilisation and minimum wastage. • Explain the recommended practices to be followed at work to avoid and resolve conflicts at work. • Explain the importance and process of efficient and timely dissemination of information to the authorised personnel. • Explain the procedure to report inappropriate behaviour e.g., harassment.	
Classroom Aids:	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements	
NA	

Module 4: Process of programming Computer Numerically Controlled (CNC) machines

Mapped to CSC/N0401 v2.0

Terminal Outcomes:

- Describe the process of preparing for programming the CNC machine for production.
- Demonstrate the process of carrying out programming for CNC machine.
- Demonstrate the process of testing and proving the program on the CNC machine.
- Demonstrate various practices for effective resource optimisation.

Duration: 40:00	Duration: 106:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain the applicable specific safe working practices to be followed. • Describe the CNC programming procedures and environmental regulations that must be observed. • Explain the use of the appropriate reference manuals and programming codes to suit the machine controller. • Explain the importance of using the correct and updated version of the program. • Explain the importance of entering the tool and work offsets correctly. • Explain how to ensure that the program does not result in tool collision with the workpiece or work holding devices. • Explain the importance of clamping the workpiece and tools firmly. • Explain the importance of using the correct control program and ensuring it is correctly loaded into the machine controller. • State the hazards associated with carrying out the machining operations on a CNC machine and how to minimize them. • List the appropriate PPE to be used during machining operations. • State the safety mechanism on various machines and how to check if they are functioning correctly. • Explain common terminology used in	• Demonstrate the use of reference charts, engineering drawings, tables and graphs to get relevant information such as tapping sizes and threads, cutting parameters, feeds, speed, depth of cut, machining tolerances, etc. • Demonstrate the process of conducting the preliminary checks to determine the readiness of the program so that the CNC machine operates correctly. • Show how to create the CNC program with commands for tool motions, spindle motions, miscellaneous functions and tool change, in syntax corresponding to the machine and control system on which the component will be machined. • Show how to use subprograms and canned cycles to reduce program size and input time, and prevent memory overflow on the machine. • Demonstrate how to transfer the program to the machine by entering it in the console or transmitting it through a wired link or a data transfer device. • Demonstrate the process of carrying out relevant documentation as per the organisational policy. • Demnstrate how to measure tool and work offset data i.e. X and Z offsets for lathes; and work offsets, length offsets and tool radius for machining

CNC programming. • Explain various features of CNC programs. • Explain the criteria for selecting the CNC strategies based on material, fixturing, holding and clamping force. • Explain the factors to be considered while selecting tungsten carbide for use, such as hardness of the component material; machinability characteristics of the material; tolerances to be achieved; etc. • Explain the importance of selecting tools based on material, finish required and tolerances achieved. • Explain the importance of cutter engagement and exit. • Explain the relevant factors affecting the tool life. • Explain the importance and effect of the depth of cut, Revolutions Per Minute (RPM) and feed. • Explain how to read and interpret first and third angle component drawings. • Explain how to extract information from engineering drawings or data and related specifications. • Explain how to use the function keys and user interface of the machine control system. • Explain how to determine the entry of work, tool offsets, tool wear data. • Explain the features and working parts of the CNC machine, and the appropriate accessories used with it. • Explain the importance of following specified machining sequences and procedures. • Explain the importance of ensuring the suitability of workpieces/materials and consumables for the specified job and related procedures. • Explain the importance and process to be followed to ensure that tools	centres. • Show how to enter work offset and tool data on the machine X and Z offsets, tool orientation and nose radius for lathes; length offsets and tool radius for machining centres. • Show how to edit the program and adjust tool and wear offsets to correct any dimensional errors on the part. • Demonstrate the process of replace the worn-out tools and indexable inserts, whenever required. • Demonstrate how to prepare and verify all technical documents for CNC programs. • Demonstrate the process of performing the appropriate quality assurance tests to ensure the final product meets the design specifications. • Demonstrate various practices to optimise the usage of various resources such as water and electricity.

and equipment are in a safe and usable condition. • Explain how to perform various CNC operations, and the use of relevant equipment. • Describe the method of setting the workholding devices. • Explain the use of various tool holding devices. • Describe the method of correctly mounting and securing the cutting tools to the tool holders. • Explain how to set the machine controller in the program and editing mode, and enter or download the prepared program. • Explain the use of automatic tool changers, pallet changers, rotary tables and part autoloaders. • Explain how to position and identify the tools in relation to the operating program. • State the relevant error messages and the appropriate actions to be taken to deal with them. • Explain the importance and process of proving the program. • Explain the importance of selecting the correct proving tools. • Explain the importance and process of storing programs on appropriate storage devices safely and correctly, and protecting them from contaminants and electromagnetic sources. • Describe the applicable quality control procedures and the use of relevant equipment. • Explain the importance of identifying and resolving problems promptly. • Explain the importance of writing programs that are easily editable or correctable by the next person. • Describe the appropriate methods for the checking quality of shaped components against the required	

quality standards. • Explain how to determine the production cost, machine hour rate, raw material cost, tool cost, coolant cost, overheads, cycle time, idle time, cost of machine idling, part rejection cost. • Explain the criteria for selecting cutting tools, tool materials, chip breaker geometry, cutting parameters from tool catalogues, and coolant. • Explain the relationship between surface finish, tool nose radius and feed rate. • State the impact of depth of cut on chatter, surface finish. • List various materials used in common engineering applications. • Explain how to identify various materials by their physical properties. • Explain the benefits of resource optimisation.	
Classroom Aids	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements	
(2-Axis CNC Machine, 3-Axis Machining Centers (VMC, HMC), > 3 Axes Machining Centers (3.5/4/5 Axes) , Measuring Tools , Hand Tools , Power Tools , PPE , Drawing Tools , GD&T , Etc.	

Module 5: Process of Assist in process improvements and machine maintenance

Mapped to CSC/N v1.0

Terminal Outcomes:

- Describe the process of assisting in process improvements and machine maintenance.

Duration: 66:00	Duration: 104:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain the importance of coordinating with engineering and supervisory personnel to troubleshoot and resolve design, equipment and operating difficulties. • Explain how to ensure optimal use of materials in various applications. • Explain the importance and process of checking all designs to find appropriate solutions to reduce manufacturing cost and time. • Desribe the process of monitoring the CNC programs to ensure accuracy of all instructions through comparison with original blueprints. • Describe the process of designing new programs for all production machines to ensure quality. • Describe the process of designing a program network to increase the efficiency of all programs. • Desribe the process of developing new processes to reduce the time for CNC programs and resolve any issues encountered with them. • Explain the importance and process of training all operators in the use of new CNC programs and equipment. • Explain the importance of checking machines periodically to ensure appropriate calibration and identifying maintenance needs. • Explain the importance of replacing the worn-out and damaged parts with manufacturer-recommended authentic parts. • Explain the importance of carrying	• Demonstrate how to design new programs for all production machines to ensure quality. • Demonstrate how to design program network to increase the efficiency of all programs. • Demonstrate the process of performing basic troubleshooting when a machine malfunctions. • Demonstrate the process of carrying out various maintenance activities such as cleaning and sharpening.

out regular and preventative maintenance as per the relevant maintenance checklists. • Explain the importance of following the manufacturer's instructions for carrying out various maintenance activities.	
Classroom Aids	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements	
NA	

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training Experience**		**Remarks**
		Years	***Specialization***	***Years***	***Specialization***	
Diploma /Degree	Diploma /Degree in Mechanical Engineering	4	CNC Programmer	0		Practical skills and knowledge required in the relevant field

Trainer Certification	
Domain Certification	**Platform Certification**
Certified for Job Role: "**CNC Programmer**" mapped to QP: "CSC/Q0401, v1.0". Minimum accepted score is 80%	Recommended that the Trainer is certified for the Job Role: "Trainer", mapped to the Qualification Pack: "MEP/Q0102". Minimum accepted as per respective SSC guidelines is 80%.

Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training/Assessment Experience**		**Remarks**
		Years	***Specialization***	***Years***	***Specialization***	
Diploma /Degree	Diploma /Degree in Mechanical Engineering	4	CNC Programmer	0		Practical skills and knowledge required in the relevant field

Assessor Certification	
Domain Certification	**Platform Certification**
Certified for Job Role: "**CNC Programmer**" mapped to QP: "CSC/Q0401, v1.0". Minimum accepted score is 80%	Certified for the Job Role: "Assessor", mapped to the Qualification Pack: "MEP/Q2701, v1.0", with a minimum score of 80%.

Assessment Strategy

1. Assessment System Overview:
    - Batches assigned to the assessment agencies for conducting the assessment on SDMS/SIP or email
    - Assessment agencies send the assessment confirmation to VTP/TC looping SSC
    - The assessment agency deploys the ToA certified Assessor for executing the assessment
    - SSC monitors the assessment process & records
2. Testing Environment

    To ensure a conducive environment for conducting a test, the trainer will:
    - Confirm that the centre is available at the same address as mentioned on SDMS or SIP
    - Check the duration of the training.
    - Check the Assessment Start and End time to be 10 a.m. and 5 p.m. respectively
    - Ensure there are 2 Assessors if the batch size is more than 30.
    - Check that the allotted time to the candidates to complete Theory & Practical Assessment is correct.
    - Check the mode of assessment—Online (TAB/Computer) or Offline (OMR/PP).
    - Confirm the number of TABs on the ground are correct to execute the Assessment smoothly.
    - Check the availability of the Lab Equipment for the particular Job Role.
3. Assessment Quality Assurance levels / Framework:
    - Question papers created by the Subject Matter Experts (SME)
    - Question papers created by the SME verified by the other subject Matter Experts
    - Questions are mapped with NOS and PC
    - Question papers are prepared considering that levels 1 to 3 are for the unskilled & semi-skilled individuals, and levels 4 and above are for the skilled, supervisor & higher management
    - The assessor must be ToA certified and the trainer must be ToT Certified
    - The assessment agency must follow the assessment guidelines to conduct the assessment
4. Types of evidence or evidence-gathering protocol:
    - Time-stamped & geotagged reporting of the assessor from assessment location
    - Centre photographs with signboards and scheme-specific branding
    - Biometric or manual attendance sheet (stamped by TP) of the trainees during the training period
    - Time-stamped & geotagged assessment (Theory + Viva + Practical) photographs & videos
5. Method of verification or validation:

    To verify the details submitted by the training centre, the assessor will undertake:
    - A surprise visit to the assessment location
    - A random audit of the batch
    - A random audit of any candidate
6. Method for assessment documentation, archiving, and access

    To protect the assessment papers and information, the assessor will ensure:
    - Hard copies of the documents are stored
    - Soft copies of the documents & photographs of the assessment are uploaded/accessed from Cloud Storage

- Soft copies of the documents & photographs of the assessment are stored on the Hard drive

References

Glossary

Term	Description
Declarative knowledge	Declarative knowledge refers to facts, concepts and principles that need to be known and/or understood in order to accomplish a task or to solve a problem.
Key Learning	The key learning outcome is the statement of what a learner needs to know, understand and be able to do in order to achieve the terminal outcomes. A set of key learning outcomes will make up the training outcomes. Training outcome is specified in terms of knowledge, understanding (theory) and skills (practical application).
OJT (M)	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on-site
OJT (R)	On-the-job training (Recommended); trainees are recommended the specified hours of training on-site
Procedural Knowledge	Procedural knowledge addresses how to do something, or how to perform a
Training Outcome	Training outcome is a statement of what a learner will know, understand and be able to do **upon the completion of the training**.
Terminal Outcome	The terminal outcome is a statement of what a learner will know, understand and be able to do **upon the completion of a module.** A set of terminal outcomes help to achieve the training outcome.

Acronyms and Abbreviations

Term	Description
NOS	National Skills Qualification Committee
NSQF	National Skills Qualification Framework
OJT	On-the-Job Training
OMR	Optical Mark Recognition
PC	Performance Criteria
PwD	Persons with Disabilities
QP	Qualification Pack
SDMS	Skill Development & Management System
SIP	Skill India Portal
SSC	Sector Skill Council
TC	Trainer Certificate
ToA	Training of Assessors
ToT	Training of Trainers
TP	Training Provider