



CNC Milling

QP Code: CSC/Q0417

Version: 1.0

NSQF Level: 4.5

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CSC/Q0417: CNC Milling

Brief Job Description

In this role the operator uses machining process that uses computer-controlled rotating, cutting tools to remove material from a workpiece to create custom-designed parts and components. One is capable to produce a wide range of shapes, sizes, and intricacies with high precision and accuracy.

Personal Attributes

A CNC milling operator is responsible for setting up, operating, and maintaining CNC milling machines to produce precision parts. They interpret technical drawings, adjust machine settings, and ensure that parts meet quality standards. Attention to detail, problem-solving skills, and technical aptitude are essential for this role.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. [CSC/N0460: Work organization and management\(milling\)](#)
2. [CSC/N0441: Interpret engineering drawings and follow the specification](#)
3. [CSC/N0442: Process planning](#)
4. [CSC/N0443: Programming](#)
5. [CSC/N0444: Metrology](#)
6. [CSC/N0445: Operating](#)
7. [CSC/N0446: Machining](#)

Qualification Pack (QP) 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, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design

Country	India
NSQF Level	4.5
Credits	16
Aligned to NCO/ISCO/ISIC Code	NCO-2015
Minimum Educational Qualification & Experience	Completed 1st year of UG (UG Certificate) (Completed 1st year of UG OR Pursuing 1st year of UG and continuous education OR Pursuing 3rd year of 3-year diploma after 10th and continuous education OR Pursuing 2nd year of 2- year diploma after 12 and continuous education OR 10th Grade pass with 1 year NTC plus 1 year NAC plus 1 year CITS OR 10th grade pass with 1 year NTC plus CITS with 1 year of relevant experience OR 8th Grade pass with 2 year NTC plus 1 year NAC plus 1 year CITS with 1 year of relevant experience OR Previous relevant Qualification of NSQF Level 3.5 and with minimum education as 8th Grade pass with 3 year relevant experience OR Previous relevant Qualification of NSQF Level 4 and with minimum education as 8th Grade pass with 1.5 year relevant experience)
Minimum Level of Education for Training in School	
Pre-Requisite License or Training	NA
Minimum Job Entry Age	22 Years
Last Reviewed On	NA
Next Review Date	NA
NSQC Approval Date	
Version	1.0

CSC/N0460: Work organization and management(milling)

Description

Work organization and management involves scheduling tasks, allocating resources, delegating responsibilities, monitoring progress, and problem-solving. This role requires strong organizational, communication, and leadership skills. It is essential for ensuring efficiency, productivity, and successful project outcomes across various industries.

Scope

The scope covers the following :

- The scope of work organization and management includes scheduling tasks, allocating resources, delegating responsibilities, monitoring progress, and problem-solving. This role is essential for ensuring efficiency, productivity, and successful project outcomes. It requires strong organizational, communication, and leadership skills, as well as the ability to analyze data and make informed decisions.

Elements and Performance Criteria

Work organization and management(milling)

To be competent, the user/individual on the job must be able to:

- PC1.** Use computer related professional software
- PC2.** Interpret and apply quality standards and regulations
- PC3.** Promote and apply health and safety regulations and best practice
- PC4.** Use IT and related professional software
- PC5.** Apply mathematical and geometrical principles accurately for the preparation and programming processes for CNC milling
- PC6.** Develop creative solutions to complex design or technology challenges

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1.** familiarity with standards such as ASME Y14.5 for dimensioning and tolerancing, and ISO 128 for technical drawings.
- KU2.** Understanding symbols and concepts used to specify geometric characteristics of parts.
- KU3.** Knowledge of materials properties and various manufacturing methods to ensure designs are feasible and cost-effective.
- KU4.** Proficiency in using CAD software (e.g., AutoCAD, SolidWorks) to create, modify, and interpret technical drawings.
- KU5.** Ability to understand complex engineering drawings, including views, sections, and annotations.
- KU6.** Effective communication with engineers, designers, and other stakeholders to clarify specifications and resolve issues.

- KU7.** Understanding of quality control processes to ensure that final products meet specified requirements.
- KU8.** Ability to identify and resolve discrepancies between drawings and specifications.
- KU9.** Thoroughness in reviewing drawings and specifications to ensure accuracy and compliance.
- KU10.** Awareness of safety standards and regulations relevant to the industry.
- KU11.** Understanding of cutting tools, feeds and speeds, and machining strategies for CNC turning and milling.
- KU12.** Knowledge of G-code programming for CNC machines to set up and operate them effectively.
- KU13.** Proficiency in using CAD software (e.g., AutoCAD, SolidWorks) for mechanical design, drafting, and creating detailed drawings.
- KU14.** Understanding of materials used in manufacturing and their properties to select the appropriate ones for specific applications.
- KU15.** Knowledge of geometric dimensioning and tolerancing (GD&T) to interpret engineering drawings accurately.
- KU16.** Awareness of safety standards and regulations relevant to CNC machining and mechanical CAD design.
- KU17.** Understanding of quality control processes to ensure that manufactured parts meet specifications.
- KU18.** Ability to troubleshoot issues related to CNC machining, tooling, or CAD designs.

Generic Skills (GS)

User/individual on the job needs to know how to:

- GS1.** Understanding of machining principles, CAD software, and mechanical systems.
- GS2.** Precision in machining and CAD design to ensure accuracy of parts and drawings.
- GS3.** Ability to troubleshoot issues with CNC machines, tooling, or CAD designs.
- GS4.** Collaboration with engineers, designers, and other team members to achieve project goals.
- GS5.** Efficient use of time to meet project deadlines and production schedules.
- GS6.** Effective communication of ideas and requirements with team members and stakeholders.
- GS7.** Flexibility to work with different materials, designs, and machining requirements.
- GS8.** Adherence to safety protocols and practices in CNC machining and CAD design environments.
- GS9.** Willingness to stay updated with new technologies and techniques in CNC machining and CAD design.

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Work organization and management(milling)</i>	20	30	-	-
PC1. Use computer related professional software	-	-	-	-
PC2. Interpret and apply quality standards and regulations	-	-	-	-
PC3. Promote and apply health and safety regulations and best practice	-	-	-	-
PC4. Use IT and related professional software	-	-	-	-
PC5. Apply mathematical and geometrical principles accurately for the preparation and programming processes for CNC milling	-	-	-	-
PC6. Develop creative solutions to complex design or technology challenges	-	-	-	-
NOS Total	20	30	-	-

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0460
NOS Name	Work organization and management(milling)
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, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design
NSQF Level	4.5
Credits	2
Version	1.0
Next Review Date	NA

CSC/N0441: Interpret engineering drawings and follow the specification

Description

This NOS involves interpretation engineering drawings and following specifications is a critical aspect of various technical roles, including manufacturing, construction, and engineering.

Scope

The scope covers the following :

- The scope of interpreting engineering drawings and following specifications is broad and applicable to various industries and professions. Professionals in manufacturing, construction, engineering, and design sectors often require this skill. Specific job titles include CAD designers, mechanical engineers, civil engineers, architects, machinists, and quality control inspectors.

Elements and Performance Criteria

: Interpret engineering drawings and follow the specification

To be competent, the user/individual on the job must be able to:

- PC1.** Interpret and apply engineering drawings and follow specifications
- PC2.** Locate and identify main dimensions and secondary dimensions
- PC3.** Locate and identify ISO standards for surface finishes Locate and identify ISO standards for geometrical form and positional tolerances
- PC4.** Locate and identify ISO standards for geometrical form and positional tolerances

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1.** familiarity with standards such as ASME Y14.5 for dimensioning and tolerancing, and ISO 128 for technical drawings.
- KU2.** Understanding symbols and concepts used to specify geometric characteristics of parts.
- KU3.** Knowledge of materials properties and various manufacturing methods to ensure designs are feasible and cost-effective.
- KU4.** Proficiency in using CAD software (e.g., AutoCAD, SolidWorks) to create, modify, and interpret technical drawings.
- KU5.** Ability to understand complex engineering drawings, including views, sections, and annotations.
- KU6.** Effective communication with engineers, designers, and other stakeholders to clarify specifications and resolve issues.
- KU7.** Understanding of quality control processes to ensure that final products meet specified requirements.
- KU8.** Ability to identify and resolve discrepancies between drawings and specifications.
- KU9.** Thoroughness in reviewing drawings and specifications to ensure accuracy and compliance.
- KU10.** Awareness of safety standards and regulations relevant to the industry.

Generic Skills (GS)

User/individual on the job needs to know how to:

- GS1.** Understanding of machining principles, CAD software, and mechanical systems.
- GS2.** Precision in machining and CAD design to ensure accuracy of parts and drawings.
- GS3.** Ability to troubleshoot issues with CNC machines, tooling, or CAD designs.
- GS4.** Collaboration with engineers, designers, and other team members to achieve project goals.
- GS5.** Efficient use of time to meet project deadlines and production schedules.
- GS6.** Effective communication of ideas and requirements with team members and stakeholders.
- GS7.** Flexibility to work with different materials, designs, and machining requirements.
- GS8.** Adherence to safety protocols and practices in CNC machining and CAD design environments.
- GS9.** Willingness to stay updated with new technologies and techniques in CNC machining and CAD design.

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>: Interpret engineering drawings and follow the specification</i>	10	40	-	-
PC1. Interpret and apply engineering drawings and follow specifications	-	-	-	-
PC2. Locate and identify main dimensions and secondary dimensions	-	-	-	-
PC3. Locate and identify ISO standards for surface finishes Locate and identify ISO standards for geometrical form and positional tolerances	-	-	-	-
PC4. Locate and identify ISO standards for geometrical form and positional tolerances	-	-	-	-
NOS Total	10	40	-	-

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0441
NOS Name	Interpret engineering drawings and follow the specification
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, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design
NSQF Level	4.5
Credits	2
Version	1.0
Next Review Date	NA

CSC/N0442: Process planning

Description

Process planning involves analyzing product designs, selecting manufacturing processes, and determining the sequence of operations. It includes tool selection, estimation of time and cost, and planning for quality control. Effective documentation and continuous improvement are also key aspects of process planning to ensure efficient and cost-effective production.

Scope

The scope covers the following :

- The scope of process planning encompasses various industries such as manufacturing, engineering, and production. Professionals in roles such as process engineers, manufacturing engineers, and production planners are involved in process planning. Tasks include analyzing product designs, selecting manufacturing processes, determining operation sequences, and estimating time and cost.

Elements and Performance Criteria

Process planning

To be competent, the user/individual on the job must be able to:

- PC1.** Identify and set the different machining features
- PC2.** Identify the most efficient work holding solution to clamp the base material into the machine
- PC3.** Select the right cutting tools for machining
- PC4.** Define the cutting parameters as a function of the operation sequence, material type, and type of operation

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1.** familiarity with standards such as ASME Y14.5 for dimensioning and tolerancing, and ISO 128 for technical drawings.
- KU2.** Understanding symbols and concepts used to specify geometric characteristics of parts.
- KU3.** Knowledge of materials properties and various manufacturing methods to ensure designs are feasible and cost-effective.
- KU4.** Proficiency in using CAD software (e.g., AutoCAD, SolidWorks) to create, modify, and interpret technical drawings.
- KU5.** Ability to understand complex engineering drawings, including views, sections, and annotations.
- KU6.** Effective communication with engineers, designers, and other stakeholders to clarify specifications and resolve issues.
- KU7.** Understanding of quality control processes to ensure that final products meet specified requirements.
- KU8.** Ability to identify and resolve discrepancies between drawings and specifications.

- KU9.** Thoroughness in reviewing drawings and specifications to ensure accuracy and compliance.
- KU10.** Awareness of safety standards and regulations relevant to the industry.
- KU11.** Understanding of cutting tools, feeds and speeds, and machining strategies for CNC turning and milling.
- KU12.** Knowledge of G-code programming for CNC machines to set up and operate them effectively.
- KU13.** Proficiency in using CAD software (e.g., AutoCAD, SolidWorks) for mechanical design, drafting, and creating detailed drawings.
- KU14.** Understanding of materials used in manufacturing and their properties to select the appropriate ones for specific applications.
- KU15.** Knowledge of geometric dimensioning and tolerancing (GD&T) to interpret engineering drawings accurately.
- KU16.** Awareness of safety standards and regulations relevant to CNC machining and mechanical CAD design.
- KU17.** Understanding of quality control processes to ensure that manufactured parts meet specifications.
- KU18.** Ability to troubleshoot issues related to CNC machining, tooling, or CAD designs.

Generic Skills (GS)

User/individual on the job needs to know how to:

- GS1.** Understanding of machining principles, CAD software, and mechanical systems.
- GS2.** Precision in machining and CAD design to ensure accuracy of parts and drawings.
- GS3.** Ability to troubleshoot issues with CNC machines, tooling, or CAD designs.
- GS4.** Collaboration with engineers, designers, and other team members to achieve project goals.
- GS5.** Efficient use of time to meet project deadlines and production schedules.
- GS6.** Effective communication of ideas and requirements with team members and stakeholders.
- GS7.** Flexibility to work with different materials, designs, and machining requirements.
- GS8.** Adherence to safety protocols and practices in CNC machining and CAD design environments.
- GS9.** Willingness to stay updated with new technologies and techniques in CNC machining and CAD design.

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Process planning</i>	10	40	-	-
PC1. Identify and set the different machining features	-	-	-	-
PC2. Identify the most efficient work holding solution to clamp the base material into the machine	-	-	-	-
PC3. Select the right cutting tools for machining	-	-	-	-
PC4. Define the cutting parameters as a function of the operation sequence, material type, and type of operation	-	-	-	-
NOS Total	10	40	-	-

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0442
NOS Name	Process planning
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, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design
NSQF Level	4.5
Credits	3
Version	1.0
Next Review Date	NA

CSC/N0443: Programming

Description

This NOS is about programming for CNC machining involves creating instructions (G-code) that control the movement and actions of the machine. It includes selecting cutting tools, specifying toolpaths, and setting machining parameters. The code is generated using CAD/CAM software and is essential for producing accurate and high-quality parts. Programming requires attention to detail, an understanding of machining processes, and the ability to optimize programs for efficiency and quality.

Scope

The scope covers the following :

- The scope of programming for CNC machining includes various industries such as manufacturing, aerospace, automotive, and prototyping. Professionals in roles such as CNC programmers, manufacturing engineers, and CNC machinists are involved in programming. Tasks include generating G-code, selecting cutting tools, simulating machining processes, and optimizing programs for efficiency and quality. Safety considerations and continuous learning are also part of the scope to ensure safe and effective CNC machining operations.

Elements and Performance Criteria

Programming

To be competent, the user/individual on the job must be able to:

- PC1.** Select the best methods according to the production type and part specification
- PC2.** Use skill specific software and related hardware
- PC3.** Generate programs by using the CAD/CAM system with the format of the initial data
- PC4.** Start with drawings in paper format to create the geometry in wireframe and/or surface and/or solid

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1.** familiarity with standards such as ASME Y14.5 for dimensioning and tolerancing, and ISO 128 for technical drawings.
- KU2.** Understanding symbols and concepts used to specify geometric characteristics of parts.
- KU3.** Knowledge of materials properties and various manufacturing methods to ensure designs are feasible and cost-effective.
- KU4.** Proficiency in using CAD software (e.g., AutoCAD, SolidWorks) to create, modify, and interpret technical drawings.
- KU5.** Ability to understand complex engineering drawings, including views, sections, and annotations.
- KU6.** Effective communication with engineers, designers, and other stakeholders to clarify specifications and resolve issues.

- KU7.** Understanding of quality control processes to ensure that final products meet specified requirements.
- KU8.** Ability to identify and resolve discrepancies between drawings and specifications.
- KU9.** Thoroughness in reviewing drawings and specifications to ensure accuracy and compliance.
- KU10.** Awareness of safety standards and regulations relevant to the industry.
- KU11.** Understanding of cutting tools, feeds and speeds, and machining strategies for CNC turning and milling.
- KU12.** Knowledge of G-code programming for CNC machines to set up and operate them effectively.
- KU13.** Proficiency in using CAD software (e.g., AutoCAD, SolidWorks) for mechanical design, drafting, and creating detailed drawings.
- KU14.** Understanding of materials used in manufacturing and their properties to select the appropriate ones for specific applications.
- KU15.** Knowledge of geometric dimensioning and tolerancing (GD&T) to interpret engineering drawings accurately.
- KU16.** Awareness of safety standards and regulations relevant to CNC machining and mechanical CAD design.
- KU17.** Understanding of quality control processes to ensure that manufactured parts meet specifications.
- KU18.** Ability to troubleshoot issues related to CNC machining, tooling, or CAD designs.

Generic Skills (GS)

User/individual on the job needs to know how to:

- GS1.** Understanding of machining principles, CAD software, and mechanical systems.
- GS2.** Precision in machining and CAD design to ensure accuracy of parts and drawings.
- GS3.** Ability to troubleshoot issues with CNC machines, tooling, or CAD designs.
- GS4.** Collaboration with engineers, designers, and other team members to achieve project goals.
- GS5.** Efficient use of time to meet project deadlines and production schedules.
- GS6.** Effective communication of ideas and requirements with team members and stakeholders.
- GS7.** Flexibility to work with different materials, designs, and machining requirements.
- GS8.** Adherence to safety protocols and practices in CNC machining and CAD design environments.
- GS9.** Willingness to stay updated with new technologies and techniques in CNC machining and CAD design.

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Programming</i>	10	40	-	-
PC1. Select the best methods according to the production type and part specification	-	-	-	-
PC2. Use skill specific software and related hardware	-	-	-	-
PC3. Generate programs by using the CAD/CAM system with the format of the initial data	-	-	-	-
PC4. Start with drawings in paper format to create the geometry in wireframe and/or surface and/or solid	-	-	-	-
NOS Total	10	40	-	-

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0443
NOS Name	Programming
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, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design
NSQF Level	4.5
Credits	3
Version	1.0
Next Review Date	NA

CSC/N0444: Metrology

Description

This NOS involves precise measurement of parts and components to ensure they meet design specifications. It includes using tools like calipers and micrometers to measure dimensions and surface finishes accurately. Quality control is a key aspect, ensuring parts meet specified tolerances and standards. Data analysis is performed to identify trends and variations in the manufacturing process.

Scope

The scope covers the following :

- The scope of metrology includes various industries such as manufacturing, aerospace, automotive, and healthcare. Professionals in roles such as quality control inspectors, metrologists, and manufacturing engineers are involved in metrology. Tasks include performing precise measurements, analyzing measurement data, and ensuring compliance with quality standards. Metrology is essential for ensuring the accuracy, reliability, and safety of products and processes in these industries.

Elements and Performance Criteria

Metrology

To be competent, the user/individual on the job must be able to:

- PC1.** Select and use appropriate measuring tools and instruments
- PC2.** Make measurements on threaded elements

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1.** familiarity with standards such as ASME Y14.5 for dimensioning and tolerancing, and ISO 128 for technical drawings.
- KU2.** Understanding symbols and concepts used to specify geometric characteristics of parts.
- KU3.** Knowledge of materials properties and various manufacturing methods to ensure designs are feasible and cost-effective.
- KU4.** Proficiency in using CAD software (e.g., AutoCAD, SolidWorks) to create, modify, and interpret technical drawings.
- KU5.** Ability to understand complex engineering drawings, including views, sections, and annotations.
- KU6.** Effective communication with engineers, designers, and other stakeholders to clarify specifications and resolve issues.
- KU7.** Understanding of quality control processes to ensure that final products meet specified requirements.
- KU8.** Ability to identify and resolve discrepancies between drawings and specifications.
- KU9.** Thoroughness in reviewing drawings and specifications to ensure accuracy and compliance.
- KU10.** Awareness of safety standards and regulations relevant to the industry.

- KU11.** Understanding of cutting tools, feeds and speeds, and machining strategies for CNC turning and milling.
- KU12.** Knowledge of G-code programming for CNC machines to set up and operate them effectively.
- KU13.** Proficiency in using CAD software (e.g., AutoCAD, SolidWorks) for mechanical design, drafting, and creating detailed drawings.
- KU14.** Understanding of materials used in manufacturing and their properties to select the appropriate ones for specific applications.
- KU15.** Knowledge of geometric dimensioning and tolerancing (GD&T) to interpret engineering drawings accurately.
- KU16.** Awareness of safety standards and regulations relevant to CNC machining and mechanical CAD design.
- KU17.** Understanding of quality control processes to ensure that manufactured parts meet specifications.
- KU18.** Ability to troubleshoot issues related to CNC machining, tooling, or CAD designs.

Generic Skills (GS)

User/individual on the job needs to know how to:

- GS1.** Understanding of machining principles, CAD software, and mechanical systems.
- GS2.** Precision in machining and CAD design to ensure accuracy of parts and drawings.
- GS3.** Ability to troubleshoot issues with CNC machines, tooling, or CAD designs.
- GS4.** Collaboration with engineers, designers, and other team members to achieve project goals.
- GS5.** Efficient use of time to meet project deadlines and production schedules.
- GS6.** Effective communication of ideas and requirements with team members and stakeholders.
- GS7.** Flexibility to work with different materials, designs, and machining requirements.
- GS8.** Adherence to safety protocols and practices in CNC machining and CAD design environments.
- GS9.** Willingness to stay updated with new technologies and techniques in CNC machining and CAD design.

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Metrology</i>	10	40	-	-
PC1. Select and use appropriate measuring tools and instruments	-	-	-	-
PC2. Make measurements on threaded elements	-	-	-	-
NOS Total	10	40	-	-

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0444
NOS Name	Metrology
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, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design
NSQF Level	4.5
Credits	3
Version	1.0
Next Review Date	NA

CSC/N0445: Operating

Description

Operating in manufacturing and engineering involves executing tasks according to standard procedures to produce goods or provide services. This includes operating machinery and equipment, following process instructions, and ensuring quality and safety standards are met. Operators play a crucial role in maintaining efficient production processes and contributing to the overall success of the organization.

Scope

The scope covers the following :

- The scope of operating roles in manufacturing and engineering is broad and encompasses various industries such as automotive, aerospace, electronics, and more. Professionals in roles such as machine operators, production technicians, and assembly line workers are involved in operating tasks. The scope includes operating machinery and equipment, following standard procedures, ensuring quality and safety standards, and contributing to process improvement initiatives.

Elements and Performance Criteria

Operating

To be competent, the user/individual on the job must be able to:

PC1. Prepare measurements and cutting tools

PC2. Identify and design the functional parameters for operation on the CNC milling machine

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1.** familiarity with standards such as ASME Y14.5 for dimensioning and tolerancing, and ISO 128 for technical drawings.
- KU2.** Understanding symbols and concepts used to specify geometric characteristics of parts.
- KU3.** Knowledge of materials properties and various manufacturing methods to ensure designs are feasible and cost-effective.
- KU4.** Proficiency in using CAD software (e.g., AutoCAD, SolidWorks) to create, modify, and interpret technical drawings.
- KU5.** Ability to understand complex engineering drawings, including views, sections, and annotations.
- KU6.** Effective communication with engineers, designers, and other stakeholders to clarify specifications and resolve issues.
- KU7.** Understanding of quality control processes to ensure that final products meet specified requirements.
- KU8.** Ability to identify and resolve discrepancies between drawings and specifications.
- KU9.** Thoroughness in reviewing drawings and specifications to ensure accuracy and compliance.
- KU10.** Awareness of safety standards and regulations relevant to the industry.

- KU11.** Understanding of cutting tools, feeds and speeds, and machining strategies for CNC turning and milling.
- KU12.** Knowledge of G-code programming for CNC machines to set up and operate them effectively.
- KU13.** Proficiency in using CAD software (e.g., AutoCAD, SolidWorks) for mechanical design, drafting, and creating detailed drawings.
- KU14.** Understanding of materials used in manufacturing and their properties to select the appropriate ones for specific applications.
- KU15.** Knowledge of geometric dimensioning and tolerancing (GD&T) to interpret engineering drawings accurately.
- KU16.** Awareness of safety standards and regulations relevant to CNC machining and mechanical CAD design.
- KU17.** Understanding of quality control processes to ensure that manufactured parts meet specifications.
- KU18.** Ability to troubleshoot issues related to CNC machining, tooling, or CAD designs.

Generic Skills (GS)

User/individual on the job needs to know how to:

- GS1.** Understanding of machining principles, CAD software, and mechanical systems.
- GS2.** Precision in machining and CAD design to ensure accuracy of parts and drawings.
- GS3.** Ability to troubleshoot issues with CNC machines, tooling, or CAD designs.
- GS4.** Collaboration with engineers, designers, and other team members to achieve project goals.
- GS5.** Efficient use of time to meet project deadlines and production schedules.
- GS6.** Effective communication of ideas and requirements with team members and stakeholders.
- GS7.** Flexibility to work with different materials, designs, and machining requirements.
- GS8.** Adherence to safety protocols and practices in CNC machining and CAD design environments.
- GS9.** Willingness to stay updated with new technologies and techniques in CNC machining and CAD design.

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Operating</i>	10	40	-	-
PC1. Prepare measurements and cutting tools	-	-	-	-
PC2. Identify and design the functional parameters for operation on the CNC milling machine	-	-	-	-
NOS Total	10	40	-	-

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0445
NOS Name	Operating
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, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design
NSQF Level	4.5
Credits	1
Version	1.0
Next Review Date	NA

CSC/N0446: Machining

Description

Machining is the process of shaping and finishing materials through the removal of excess material. It involves using various tools and machines, such as lathes, mills, and grinders, to achieve precise dimensions and surface finishes. Machinists interpret technical drawings, select the appropriate tools, and set up machines to perform the necessary operations.

Scope

The scope covers the following :

- The scope of machining encompasses various industries such as automotive, aerospace, electronics, and more. Professionals in roles such as machinists, CNC operators, and manufacturing engineers are involved in machining. Tasks include interpreting technical drawings, selecting tools and materials, setting up machines, and producing precision parts. Machining plays a critical role in manufacturing, producing components with tight tolerances and high quality.

Elements and Performance Criteria

Machining

To be competent, the user/individual on the job must be able to:

- PC1.** Identify and designate the different machining processes on a CNC milling machine
- PC2.** Optimize the machining strategy
- PC3.** Define and adjust the cutting parameters as a function of the operation sequence, material type, type of operation, and CNC machine tool
- PC4.** Start the cutting process from the raw material
- PC5.** Solid block
- PC6.**
 - Perform the following machining operations:
 - Facing
 - Roughing and finishing
- PC7.** External contours
- PC8.** Island milling
- PC9.** Milling channels

- PC10.**
- Pocket (figurative)
 - Pocket (circular and rectangular)
 - Taper ribs
 - Thread milling
 - Internal
 - External
 - Canned cycles
 - Through hole boring
 - Blind hole boring
 - Reaming
 - Tapping
 - Drilling
 - 3D machining operations
 - Roughing
 - Finishing
- PC11.** Tapping
- PC12.** Drilling
- PC13.** 3D machining operations
- PC14.** Roughing
- PC15.** Finishing

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1.** familiarity with standards such as ASME Y14.5 for dimensioning and tolerancing, and ISO 128 for technical drawings.
- KU2.** Understanding symbols and concepts used to specify geometric characteristics of parts.
- KU3.** Knowledge of materials properties and various manufacturing methods to ensure designs are feasible and cost-effective.
- KU4.** Proficiency in using CAD software (e.g., AutoCAD, SolidWorks) to create, modify, and interpret technical drawings.
- KU5.** Ability to understand complex engineering drawings, including views, sections, and annotations.
- KU6.** Effective communication with engineers, designers, and other stakeholders to clarify specifications and resolve issues.
- KU7.** Understanding of quality control processes to ensure that final products meet specified requirements.
- KU8.** Ability to identify and resolve discrepancies between drawings and specifications.
- KU9.** Thoroughness in reviewing drawings and specifications to ensure accuracy and compliance.
- KU10.** Awareness of safety standards and regulations relevant to the industry.
- KU11.** Understanding of cutting tools, feeds and speeds, and machining strategies for CNC turning and milling.
- KU12.** Knowledge of G-code programming for CNC machines to set up and operate them effectively.
- KU13.** Proficiency in using CAD software (e.g., AutoCAD, SolidWorks) for mechanical design, drafting, and creating detailed drawings.

- KU14.** Understanding of materials used in manufacturing and their properties to select the appropriate ones for specific applications.
- KU15.** Knowledge of geometric dimensioning and tolerancing (GD&T) to interpret engineering drawings accurately.
- KU16.** Awareness of safety standards and regulations relevant to CNC machining and mechanical CAD design.
- KU17.** Understanding of quality control processes to ensure that manufactured parts meet specifications.
- KU18.** Ability to troubleshoot issues related to CNC machining, tooling, or CAD designs.

Generic Skills (GS)

User/individual on the job needs to know how to:

- GS1.** Understanding of machining principles, CAD software, and mechanical systems.
- GS2.** Precision in machining and CAD design to ensure accuracy of parts and drawings.
- GS3.** Ability to troubleshoot issues with CNC machines, tooling, or CAD designs.
- GS4.** Collaboration with engineers, designers, and other team members to achieve project goals.
- GS5.** Efficient use of time to meet project deadlines and production schedules.
- GS6.** Effective communication of ideas and requirements with team members and stakeholders.
- GS7.** Flexibility to work with different materials, designs, and machining requirements.
- GS8.** Adherence to safety protocols and practices in CNC machining and CAD design environments.
- GS9.** Willingness to stay updated with new technologies and techniques in CNC machining and CAD design.

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Machining</i>	30	70	-	-
PC1. Identify and designate the different machining processes on a CNC milling machine	-	-	-	-
PC2. Optimize the machining strategy	-	-	-	-
PC3. Define and adjust the cutting parameters as a function of the operation sequence, material type, type of operation, and CNC machine tool	-	-	-	-
PC4. Start the cutting process from the raw material	-	-	-	-
PC5. Solid block	-	-	-	-
PC6. <ul style="list-style-type: none"> • Perform the following machining operations: • Facing • Roughing and finishing 	-	-	-	-
PC7. External contours	-	-	-	-
PC8. Island milling	-	-	-	-
PC9. Milling channels	-	-	-	-
PC10. <ul style="list-style-type: none"> • Pocket (figurative) • Pocket (circular and rectangular) • Taper ribs • Thread milling • Internal • External • Canned cycles • Through hole boring • Blind hole boring • Reaming • Tapping • Drilling • 3D machining operations • Roughing • Finishing 	-	-	-	-
PC11. Tapping	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. Drilling	-	-	-	-
PC13. 3D machining operations	-	-	-	-
PC14. Roughing	-	-	-	-
PC15. Finishing	-	-	-	-
NOS Total	30	70	-	-

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0446
NOS Name	Machining
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, Defence Equipment, Fire-Fighting & Safety Equipment
Occupation	Design
NSQF Level	4.5
Credits	2
Version	1.0
Next Review Date	NA

Assessment Guidelines and Assessment Weightage

Assessment Guidelines

Assessment Guidelines

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down the proportion of marks for Theory and Skills Practical for each PC.
2. The assessment for the theory part will be based on the knowledge bank of questions created by the SSC.
3. Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.
4. Individual assessment agencies will create unique question papers for the theory part for each candidate at each examination/training centre (as per assessment criteria below).
5. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/ training centre based on these criteria.
6. To pass the Qualification Pack assessment, every trainee should score a minimum of 70% of % aggregate marks to successfully clear the assessment.

7. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack.

Minimum Aggregate Passing % at QP Level : 70

(Please note: Every Trainee should score a minimum aggregate passing percentage as specified above, to successfully clear the Qualification Pack assessment.)

Assessment Weightage

Compulsory NOS

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
CSC/N0460.Work organization and management(milling)	20	30	0	0	50	10
CSC/N0441.Interpret engineering drawings and follow the specification	10	40	0	0	50	10
CSC/N0442.Process planning	10	40	0	0	50	15
CSC/N0443.Programming	10	40	0	0	50	20
CSC/N0444.Metrology	10	40	0	0	50	10
CSC/N0445.Operating	10	40	0	0	50	15
CSC/N0446.Machining	30	70	-	-	100	20
Total	100	300	-	-	400	100

Acronyms

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training

Glossary

Sector	Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
Sub-sector	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
Occupation	Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
Occupational Standards (OS)	OS specify the standards of performance an individual must achieve when carrying out a function in the workplace, together with the Knowledge and Understanding (KU) they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
Performance Criteria (PC)	Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
National Occupational Standards (NOS)	NOS are occupational standards which apply uniquely in the Indian context.
Qualifications Pack (QP)	QP comprises the set of OS, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualifications pack code.
Unit Code	Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'
Unit Title	Unit title gives a clear overall statement about what the incumbent should be able to do.
Description	Description gives a short summary of the unit content. This would be helpful to anyone searching on a database to verify that this is the appropriate OS they are looking for.
Scope	Scope is a set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required.
Knowledge and Understanding (KU)	Knowledge and Understanding (KU) are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard.

Organisational Context	Organisational context includes the way the organisation is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
Technical Knowledge	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Core Skills/ Generic Skills (GS)	Core skills or Generic Skills (GS) are a group of skills that are the key to learning and working in today's world. These skills are typically needed in any work environment in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication related skills that are applicable to most job roles.
Electives	Electives are NOS/set of NOS that are identified by the sector as contributive to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select at least one elective for the successful completion of a QP with Electives.
Options	Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options.