

# Model Curriculum

## 14. CNC Operator- Vertical Machining Center

**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, DIES, MOULDS AND PRESS TOOLS**

**OCCUPATION: MACHINING**  
**REF ID: CSC/Q0116, V1.0**  
**NSQF LEVEL: 3**



## Certificate

### CURRICULUM COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

**CAPITAL GOODS SKILL COUNCIL**

for the

**MODEL CURRICULUM**

Complying to National Occupational Standards of  
Job Role/Qualification Pack: 'CNC Operator-Vertical Machining Centre' QP No. 'CSC/Q0116, NSQF Level 3'

Date of Issuance: April 14<sup>th</sup>, 2014

Valid up to : August 30<sup>th</sup>, 2016

\*Valid up to the next review date of the Qualification Pack, or the  
Valid up to' date mentioned above (whichever is earlier)



Authorised Signatory  
Tourism & Hospitality Skill Council

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# CNC Operator- Vertical Machining Centre

## CURRICULUM / SYLLABUS

This program is aimed at training candidates for the job of a “CNC Operator- Vertical Machining Center”, in the “Capital Goods” Sector/Industry and aims at building the following key competencies amongst the learner

<b>Program Name</b>	<b>CNC Operator-Vertical Machining Center</b>		
<b>Qualification Pack Name &amp; Reference ID. ID</b>	CSC/Q0116, v1.0		
<b>Version No.</b>	1.0	<b>Version Update Date</b>	
<b>Pre-requisites to Training</b>	10th Standard passed, preferably		
<b>Training Outcomes</b>	<p><b>After completing this programme, participants will be able to:</b></p> <ul style="list-style-type: none"> <li>• <b>Perform range of operations on metal components using computer numerical control Vertical Machining center:</b> Operation of Computer Numerically Controlled (CNC) vertical machining center (VMC) with 3-axis, in order to perform multiple machining operations on metal and plastic components, as per specifications.</li> <li>• <b>Basic health and safety practices at the workplace:</b> identify risks and hazards at workplace, use of PPE, and apply good housekeeping practices, etc.,</li> <li>• <b>Work effectively with others:</b> effectively communicate with others and demonstrate good ethical practices and discipline.</li> </ul>		

This course encompasses 3 out of 3 National Occupational Standards (NOS) of “CNC Operator- Vertical Machining Center” Qualification Pack issued by “Capital Goods Skill Council”.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	<p><b>Perform a Range of Operations on Metal Components Using Computer Numerical Controlled Vertical Machining Center</b></p> <p><b>Theory Duration</b> (hh:mm) 40:00</p> <p><b>Practical Duration</b> (hh:mm) 100:00</p> <p><b>Corresponding NOS Code</b> CSC/N0116</p>	<ul style="list-style-type: none"> <li>• Explain safety practices to be followed while operating Vertical Machining Center</li> <li>• Identify required Personal Protective Equipment required for machining operation</li> <li>• Wear Personal Protective Equipment correctly</li> <li>• Locate safety mechanisms on the machine (Emergency stop button and emergency brakes)</li> <li>• Identify hazards associated with VMC and take preventive actions to avoid such hazards</li> <li>• Identify various types of materials like carbon steel, stainless steel, cast iron, tool steel, bronze, aluminium, copper and copper alloys etc.</li> <li>• Identify different form of materials like bar, stock ,sheet materials and machined components</li> <li>• Identify casted, forged and machined components</li> <li>• Explain mechanical properties of ferrous and non ferrous materials</li> <li>• Interpret First angle and third angle engineering drawing</li> <li>• Read and interpret work instructions</li> <li>• Explain common terms used in VMC machining</li> <li>• Explain units and systems of measurements (British and Metric units)</li> <li>• Convert units from one system of measurement to another</li> <li>• Identify measuring equipments required for machining like scales, micrometer, vernier, slip gauge, bore/hole gauge, thread gauge, plug gauge, radius /profile gauge, Dial test indicator and surface finish equipment</li> <li>• List main features and working parts of the VMC</li> <li>• Identify tools and accessories used in VMC machining</li> <li>• Identify right kind of tool for a specific operation – mills, drills, boring tool, reamers, taps, special profile cutters</li> <li>• List work holding devices required machining operation</li> <li>• Explain important characteristics of</li> </ul>	<p>Training Kit (PowerPoint, Trainer Guide)</p> <p>CNC Controlled Vertical Machining Center – 3 axis, allen keys, spanner, wrenches, mallet, pneumatic gun, cutting tools, scales, external micrometer, internal micrometer, depth micrometer, digital vernier, dial vernier, protractor, slip gauge, bore/hole gauge, thread gauge, plug gauge, radius/profile gauge, DTI, surface finish equipment, templates</p>

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>tungsten carbide, ceramic and diamond indexable tips</p> <ul style="list-style-type: none"> <li>• Explain effects of critical factors on the machining like feed and speed</li> <li>• Explain absolute and incremental systems of tool positioning and off setting</li> <li>• Explain various CNC machining operations that can be performed</li> <li>• Identify cutting tool based on the application</li> <li>• Interpret error messages displayed on the control panel</li> <li>• Identify commonly used hand tools like allen keys, spanner, wrenches, mallet, pneumatic gun etc.</li> <li>• Conduct preliminary check on the machine to check for readiness – referencing zero return, lubrication level, coolant level etc.</li> <li>• Perform simple troubleshooting activities during the machining</li> <li>• Perform basic maintenance activities like coolant and lubrication oil replenishment, greasing etc.</li> <li>• Set work piece as per the instruction</li> <li>• Load and unload components using pre determined fixtures or work holding devices</li> <li>• Carryout trial run by taking back the tool offsets by a minimum amount keeping margin error rectification</li> <li>• Measure the critical parameters of the machined component on the machine after the trial run</li> <li>• Perform offsets compensation and radius compensation</li> <li>• Produce machined components that combine different operations and have a range of applicable features - flat, square, parallel, angular, steps/shoulder, slots, holes, profiles, special forms, grooves, undercuts, threads and radius</li> <li>• produce components as per standards applicable to the process components to be free from false tool cuts, burrs and sharp edges; general dimensional tolerance +/- 0.02mm; surface finish within 1.6µm; reamed holes within H7; screw threads 6G/6H; angles/tapers within +/- 15 sec; flatness and squareness 0.025mm per 25mm</li> <li>• Interpret in-built alarms and error codes</li> </ul>	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		<p>of equipment and respond to the same as per operating manual/organizational guidelines</p> <ul style="list-style-type: none"> <li>Inspect tool for wear and change tool as and when necessary</li> <li>Fill up appropriate technical forms ,activity logs as per the requirement</li> <li>Follow proper communication protocol</li> <li>Communicate with people in respectful manner in line with organizational policy</li> <li>Perform numerical operations, geometry and calculations</li> <li>Maintain current knowledge of application standards, legislation etc.</li> <li>Demonstrate problem solving abilities</li> <li>Plan, organize and sequence work operations as per the job requirement</li> <li>Work in a team to achieve better results</li> </ul>	
2	<p><b>Health and safety</b></p> <p><b>Theory Duration</b> (hh:mm) 10:00</p> <p><b>Practical Duration</b> (hh:mm) 08:00</p> <p><b>Corresponding NOS Code</b> CSC/N1335</p>	<ul style="list-style-type: none"> <li>Explain the importance of personal protective equipment (PPE) required for gas cutting operation</li> <li>State the causes for accidents</li> <li>Identify job site hazardous work and state possible causes of risk or accident at the workplace</li> <li>Explain the importance of '5S' at the workplace</li> </ul>	<p>Training kit (Trainer guide, PowerPoint)</p> <p>Leather gloves, leather apron, welding screen – helmet types, hand screen welding and safety shoes</p>
3	<p><b>Fire Safety</b></p> <p><b>Theory Duration</b> (hh:mm) 05:00</p> <p><b>Practical Duration</b> (hh:mm) 30:00</p> <p><b>Corresponding NOS Code</b> CSC/N1335</p>	<ul style="list-style-type: none"> <li>Explain types of fires - Class A, B, C and D</li> <li>Select appropriate fire extinguisher to control fire</li> <li>Use PASS method to operate a fire extinguisher</li> <li>Follow fire safety signs and safe evacuation method in case of a fire</li> <li>Identify the location of assembly point, fire exit, fire alarm</li> <li>Follow reporting procedure in case of a fire</li> </ul>	<p>Training kit (Trainer guide, PowerPoint)</p> <p>Class A, B, C, D and K fire extinguishers</p>
4	<p><b>Emergencies, rescue and first aid procedure</b></p> <p><b>Theory Duration</b> (hh:mm) 09:00</p>	<ul style="list-style-type: none"> <li>Follow electrical safety procedures</li> <li>Use approved method to rescue a person from electrocution</li> <li>State the importance of first aid</li> <li>Identify the contents of a first aid kit and their application</li> </ul>	<p>Training kit (Trainer guide, PowerPoint)</p> <p>First aid kit with all contents</p>

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	<p><b>Practical Duration</b> (hh:mm) 18:00</p> <p><b>Corresponding NOS Code</b> CSC/N1335</p>	<ul style="list-style-type: none"> <li>Administer first aid in case of bleeding, burns, choking, electrical shock, poisoning, etc.</li> <li>Use of CPR process</li> <li>Bandage wounds</li> <li>Explain stages of crisis and crisis management</li> <li>Prepare an incident report</li> </ul>	
5	<p><b>Work effectively with others</b></p> <p><b>Theory Duration</b> (hh:mm) 20:00</p> <p><b>Practical Duration</b> (hh:mm) 60:00</p> <p><b>Corresponding NOS Code</b> CSC/N1336</p>	<ul style="list-style-type: none"> <li>Explain the importance of team work and team dynamics</li> <li>State 4Cs of working in a team</li> <li>Explain types of communication</li> <li>Apply effective communication technique</li> <li>Overcome barriers to effective communication</li> <li>Demonstrate active listening skills</li> <li>Demonstrate good customer service skills</li> <li>Explain the importance of ethical behaviour in your day-to-day work</li> <li>State the importance of discipline in life and apply the same at workplace</li> </ul>	Training kit (Trainer guide, PowerPoint)
6	<p><b>Final Assessment</b></p> <p><b>Theory Duration</b> (hh:mm) 04:00</p> <p><b>Practical Duration</b> (hh:mm) 06:00</p> <p><b>Corresponding NOS Code</b></p>	<ul style="list-style-type: none"> <li>To test skills and knowledge</li> </ul>	
	<p><b>Total Duration</b></p> <p><b>Theory Duration</b> <b>88:00</b></p> <p><b>Practical Duration</b> <b>222:00</b></p>	<p><b>Unique Equipment Required:</b> CNC Controlled Vertical Machining Center – 3 axis, allen keys, spanner, wrenches, mallet, pneumatic gun, cutting tools, scales, external micrometer, internal micrometer, depth micrometer, digital vernier, dial vernier, protractor, slip gauge, bore/hole gauge, thread gauge, plug gauge, radius/profile gauge, DTI, surface finish equipment, templates, Class A, B, C, D and K fire extinguishers, PPE, First aid kit with all contents</p>	

Grand Total Course Duration: **310 Hours, 0 Minutes**

(This syllabus/ curriculum has been approved by [Capital Goods Skill Council](#))



## Trainer Prerequisites for Job role: “CNC Operator- Vertical Machining Center” mapped to Qualification Pack: “CSC/Q0116 v1.0”

Sr. No.	Area	Details
1	<b>Description</b>	Operation of Computer Numerically Controlled (CNC) vertical machining center (VMC), in order to perform machining operations on metal components, as per specifications provided.
2	<b>Personal Attributes</b>	Basic communication, numerical and computational abilities. Openness to learning, ability to plan and organize own work and identify and solve problems in the course of working. Understanding the need to take initiative and manage self and work to improve efficiency and effectiveness.
3	<b>Minimum Educational Qualifications</b>	Diploma /Degree in Mechanical Engineering
4a	<b>Domain Certification</b>	Certified for Job Role: “CNC Operator- Vertical Machining Center” mapped to QP: “CSC/Q0116, v1.0”. Minimum accepted score is 80%
4b	<b>Platform Certification</b>	Recommended that the Trainer is certified for the Job Role: “Trainer”, mapped to the Qualification Pack: “SSC/Q1402”. Minimum accepted 70 % as per respective SSC guidelines is 70%.
5	<b>Experience</b>	<ul style="list-style-type: none"> <li>• 3-4 years of industry experience in the relevant field</li> <li>• 3-4 years of teaching experience</li> </ul>

### Annexure: Assessment Criteria

<b>Assessment Criteria</b>	
<b>Job Role</b>	<b>CNC Operator- Vertical Machining Center</b>
<b>Qualification Pack</b>	<b>CSC/Q0116, v1.0</b>
<b>Sector Skill Council</b>	<b>Capital Goods Skill Council</b>

<b>Sr. No.</b>	<b>Guidelines for Assessment</b>
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 proportion of marks for Theory and Skills Practical for each PC.
2	The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre(as per assessment criteria below)
4	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criteria
5	To pass the Qualification Pack, every trainee should score a minimum of 60% in aggregate and 40% in each NOS
6	The marks are allocated PC wise; however, every NOS will carry a weight age in the total marks allocated to the specific QP

Assessable Outcome	Assessment Criteria	Total Mark (300)	Out Of	Marks Allocation	
				Theory	Skills Practical
<b>1.CSC/N0116</b> Perform a range of operations on metal components using computer numerical controlled vertical machining center	PC1.comply with health and safety, environmental and other relevant regulations and guidelines at work	<b>100</b>	2	1	1
	PC2.adhere to procedures and guidelines for personal protective equipment (PPE) and other relevant safety regulations while performing machining operations		3	1	2
	PC3.work following laid down procedures and instructions		1	0	1
	PC4.ensure work area is clean and safe from hazards		1	0	1
	PC5.ensure that all tools and equipment are in a safe and usable condition		1	0	1
	PC6.obtain job specification from a valid and approved source		1	0	1
	PC7.read and establish job requirements from the job specification document accurately		3	1	2
	PC8.report and rectify incorrect and inconsistent information in job specification documents as per organization procedures		2	0	2
	PC9.use and extract information from reference charts, tables, graphs and standards		3	1	2
	PC10.prepare the work area for the machining operations as per procedure or operational specification		3	1	2
	PC11.ensure that the components used are free from foreign objects, dirt or other contamination		1	0	1
	PC12.conduct a preliminary check of the readiness of the vertical machining center		1	0	1
	PC13.obtain correct work pieces/raw materials and consumables as per job requirements		2	1	1
	PC14.obtain appropriate cutting tools, hand tools and measuring tools as per job requirements		3	1	2
	PC15.ensure that all measuring equipment is calibrated and approved for usage		2	0	2
	PC16.set work pieces as per job requirements using appropriate positioning and/or holding devices and support mechanisms		3	1	2
	PC17.where appropriate, seek any necessary instruction/training on the operation of the machine		2	0	2
	PC18.check that the operating program is at the correct start point and the work piece is clear of the machine spindle		2	0	2
	PC19.switch the vertical machining center on and off in normal and emergency situations		1	0	1
	PC20.load and unload component(s) using pre-		3	1	2

Assessable Outcome	Assessment Criteria	Total Mark (300)	Out Of	Marks Allocation	
				Theory	Skills Practical
	determined fixtures or work holding devices as per work instructions				
	PC21. do trial run by taking back the tool offsets by a minimum amount keeping margin error rectification		2	0	2
	PC22.measure the critical parameters of the machined component on the machine (without removing from the machine), after the trial run		3	1	2
	PC23.correct the offsets based on the measurements by accessing program edit facility in order to enter tooling data		3	1	2
	PC24.ensure accuracy in the critical parameters of the machined components by performing multiple trial runs and subsequent adjustment of offsets		3	1	2
	PC25.measure the component after unloading to check for accuracy in the critical parameters as per job specifications		4	1	3
	PC26.produce machined components that combine different operations and have a range of applicable features		4	2	2
	PC27.follow the specified machining sequence and procedure as per job specifications		3	1	2
	PC28.interpret in-built alarms and error codes of equipment and respond to the same as per operating manual/organizational guidelines		3	1	2
	PC29.inspect as per frequency of inspection mentioned in the inspection plan (part of the job specifications)		3	1	2
	PC30.record the measured values as per organizational procedure		2	1	1
	PC31.observe for inconsistency in dimensions due to tool wear and correct the offsets accordingly		2	1	1
	PC32.ensure that machine settings are adjusted as and when required, either by self or the setter, to maintain the required accuracy		4	2	2
	PC33.identify when tools need re sharpening/replacing		3	1	2
	PC34.remove worn out tool and replace with a suitable tool		2	0	2
	PC35.perform basic maintenance checks on the machine after operations		4	1	3
	PC36.keep finished components as well as raw material as per organizational procedure established		1	0	1
	PC37.produce components as per standards		4	1	3

Assessable Outcome	Assessment Criteria	Total Mark (300)	Out Of	Marks Allocation	
				Theory	Skills Practical
	applicable to the process				
	PC38. work to achieve production targets		2	0	2
	PC39.report conditions and seek appropriate assistance in a timely manner to address risk of failure to comply with necessary targets and specifications		2	0	2
	PC40.deal with finished components as per organizational guidelines		2	0	2
	PC41.return all tools and equipment to the correct location on completion of the machining activities		1	0	1
	PC42.update log book and complete necessary documentation during and post operations as per organizational procedures		1	0	1
	PC43.leave the work area in a safe and tidy condition on completion of job activities		2	0	2
	<b>Total</b>		<b>100</b>	<b>17</b>	<b>70</b>
<b>2.CSC/N1335</b> <b>Use basic health and safety practices at the workplace</b>	PC1.use protective clothing/equipment for specific tasks and work conditions	<b>100</b>	5	2	3
	PC2.state the name and location of people responsible for health and safety in the workplace		3	1	2
	PC3.state the names and location of documents that refer to health and safety in the workplace		3	1	2
	PC4.identify job-site hazardous work and state possible causes of risk or accident in the workplace		5	2	3
	PC5.carry out safe working practices while dealing with hazards to ensure the safety of self and others state methods of accident prevention in the work environment of the job role		4	2	2
	PC6.state location of general health and safety equipment in the workplace		3	2	1
	PC7.inspect for faults, set up and safely use steps and ladders in general use		5	2	3
	PC8.work safely in and around trenches, elevated places and confined areas		5	2	3
	PC9.lift heavy objects safely using correct procedures		5	2	3
	PC10.apply good housekeeping practices at all times		4	2	2
	PC11.identify common hazard signs displayed in various areas		5	2	3
	PC12.retrieve and/or point out documents that refer to health and safety in the workplace		3	1	2

Assessable Outcome	Assessment Criteria	Total Mark (300)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC13.use the various appropriate fire extinguishers on different types of fires correctly		4	1	3
	PC14.demonstrate rescue techniques applied during fire hazard		4	1	3
	PC15.demonstrate good housekeeping in order to prevent fire hazards		3	1	2
	PC16.demonstrate the correct use of a fire extinguisher		4	1	3
	PC17.demonstrate how to free a person from electrocution		4	1	3
	PC18.administer appropriate first aid to victims where required eg. in case of bleeding, burns, choking, electric shock, poisoning etc.		4	1	3
	PC19.demonstrate basic techniques of bandaging		3	1	2
	PC20.respond promptly and appropriately to an accident situation or medical emergency in real or simulated environments		4	1	3
	PC21.perform and organize loss minimization or rescue activity during an accident in real or simulated environments		3	1	2
	PC22.administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock, before the arrival of emergency services in real or simulated cases		3	1	2
	PC23.demonstrate the artificial respiration and the CPR Process		3	1	2
	PC24.participate in emergency procedures		3	2	1
	PC25.complete a written accident/incident report or dictate a report to another person, and send report to person responsible		4	1	3
	PC26.demonstrate correct method to move injured people and others during an emergency		4	1	3
	<b>Total</b>		<b>100</b>	<b>36</b>	<b>64</b>
<b>3.CSC/N1336 Work effectively with others</b>	PC1.accurately receive information and instructions from the supervisor and fellow workers, getting clarification where required	<b>100</b>	10	3	7
	PC2.accurately pass on information to authorized persons who require it and within agreed timescale and confirm its receipt		10	3	7
	PC3.give information to others clearly, at a pace and in a manner that helps them to understand		10	3	7

Assessable Outcome	Assessment Criteria	Total Mark (300)	Out Of	Marks Allocation	
				Theory	Skills Practical
	PC4.display helpful behavior by assisting others in performing tasks in a positive manner, where required and possible		10	3	7
	PC5.consult with and assist others to maximize effectiveness and efficiency in carrying out tasks		10	3	7
	PC6.display appropriate communication etiquette while working		10	3	7
	PC7.display active listening skills while interacting with others at work		10	3	7
	PC8.use appropriate tone, pitch and language to convey politeness, assertiveness, care and professionalism		10	3	7
	PC9.demonstrate responsible and disciplined behaviors at the workplace		10	3	7
	PC10.escalate grievances and problems to appropriate authority as per procedure to resolve them and avoid conflict		10	3	7
	<b>Total</b>		<b>100</b>	<b>30</b>	<b>70</b>
	<b>Grand Total</b>	<b>300</b>	<b>300</b>	<b>86</b>	<b>204</b>
	<b>Percentage Weightage:</b>			<b>29</b>	<b>77</b>
	<b>Minimum Pass% to qualify (aggregate):</b>				<b>60</b>