Model Curriculum

CNC Operator- Vertical Machining Centre

SECTOR:	**CAPITAL GOODS**
SUB-SECTOR:	**1. Machine Tools**
	2. Dies, Moulds and Press Tools
	3. Plastics Manufacturing Machinery
	4. Textile Manufacturing Machinery
	5. Process Plant Machinery
	6. Electrical and Power Machinery
	7. Light Engineering Goods
OCCUPATION:	**Machining**
REF ID:	**CSC/Q0116, v1.0**
NSQF LEVEL:	**3**

Skill India
कौशल भारत-कुशल भारत

CGSC
CAPITAL GOODS SKILL COUNCIL

N·S·D·C
National Skill Development Corporation
Transforming the skill landscape

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: **November 24th, 2017**

Valid up to*: **November 24th, 2021**

**Valid up to the next review date of the Qualification Pack*

Authorised Signatory
(Capital Goods Skills 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 Centre", in the "Capital Goods" Sector/Industry and aims at building the following key competencies amongst the learner

Program Name	**CNC Operator- Vertical Machining Centre**		
Qualification Pack Name & Reference ID. ID	CSC/Q0116, v1.0		
Version No.	1.0	**Version Update Date**	19/09/2018
Pre-requisites to Training	10th Standard pass, preferably		
Training Outcomes	**After completing this programme, participants will be able to:** • Perform range of operations on metal components using computer numerical controlled Vertical Machining Centre. • Follow basic healthy and work safety at the workplace. • Work effectively with colleagues and supervisors.		

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

Sr. No.	Module	Key Learning Outcomes	Equipment Required
1	**Performing a range of operations on metal components using computer numerical controlled vertical machining centre** **Theory Duration** (hh:mm) 40:00 **Practical Duration** (hh:mm) 100:00 **Corresponding NOS Code** CSC/N0116	• Identify various types of materials that can be machined. • Identify different form of materials. • Identify casted, forged and machined components. • Explain mechanical properties of ferrous and non-ferrous materials. • Explain common terms used in VMC machining. • Explain units and systems of measurements. • Identify measuring equipment's required for machining. • List main features and working parts of the VMC. • Explain safety practices to be followed while operating Vertical Machining Centre. • Identify required Personal Protective Equipment required for machining operation. • Locate safety mechanisms on the machine and ensure that they are functional. • Identify hazards associated with VMC to avoid accidents. • Identify tools and accessories used in VMC machining. • Identify right kind of tool for a specific operation. • Identify work holding devices required machining operation. • Explain important characteristics of tungsten carbide, ceramic and diamond indexable tips. • Explain effects of critical factors on the machining like feed and speed. • Describe absolute and incremental systems of tool positioning and off setting. • Describe various CNC machining operations that can be performed. • Identify cutting tool based on the application. • Interpret error messages displayed on the control panel. • Identify commonly used hand tools required for machining. • Conduct preliminary check on the machine to check for machine readiness.	Training Kit (Presentations, Trainer Guide), CNC controlled vertical machining Centre – 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, dial test indicators (DTI), surface finish equipment, templates

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		• Perform simple troubleshooting activities during the machining. • Perform basic maintenance activities. • Read and interpret 'First angle' and 'Third angle' engineering drawing. • Read and interpret work instructions. • Set work piece as per instructions. • Load and unload components using predetermined fixtures or work holding devices. • Measure the critical parameters of the machined component on the machine after the trial run. • Perform offsets compensation and radius compensation. • Produce machined components that combine different operations and have a range of applicable features. • Produce components as per standards applicable to the process. • Interpret in-built alarms and error codes of equipment and respond to the same as per operating manual/organizational guidelines. • Inspect tool to check for wear and change tool as and when necessary. • Fill up appropriate technical forms, activity logs as per the requirement. • Perform numerical operations, geometry and calculations. • Plan, organize and sequence work operations as per the job requirement.	
2	**Health and safety** **Theory Duration** (hh:mm) 10:00 **Practical Duration** (hh:mm) 08:00 **Corresponding NOS Code** CSC/N1335	• Explain the importance of Personal Protective Equipment (PPE). • Identify appropriate PPE for the various tasks performed. • Identify job site risks and hazards to avoid accidents at the work place. Hazards: sharp edged and heavy tools; heated metals; gas cylinders; welding radiation; hazardous surfaces(sharp, slippery, uneven, chipped, broken, etc.); hazardous substances(chemicals, gas, fumes, dust, etc.); physical hazards(working at heights, large and heavy objects and machines, sharp and piercing objects, tools and machines, intense light, load noise, obstructions in corridors, by doors, blind turns, noise, over stacked shelves and packages, etc.) electrical hazards (power supply and points, loose and naked cables	Training kit (Trainer guide, Presentation), leather gloves, leather apron, welding screen – helmet types, hand screen welding and safety shoes

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		and wires, electrical machines and appliances, etc.) Possible causes of risk and accident: physical actions; reading; listening to and giving instructions; inattention; sickness and incapacity (such as drunkenness); health hazards (such as untreated injuries and contagious illness) • Identify the names and locations of people responsible for health and safety in the workplace. • Identify documents that refer to health and safety in the workplace and where they are located. • Carry out safe working practices while dealing with hazards to ensure the safety of self and others. Safe working practices: using protective clothing and equipment; putting up and reading safety signs; handle tools in the correct manner and store and maintain them properly; keep work area clear of clutter, spillage and unsafe object lying casually; while working with electricity take all electrical precautions like insulated clothing, adequate equipment insulation, use of control equipment, dry work area, switch off the power supply when not required, etc.; safe lifting and carrying practices; use equipment that is working properly and is well maintained; take due measures for safety while working in confined places, trenches or at heights, etc. including safety harness, fall arrestors, etc. • Inspect steps and ladders for faults, set them and use them safely. Ladder faults: corrosion of metal components, deterioration, splits and cracks timber components, imbalance, loose rungs, missing/ unfixed nuts or bolts, etc. Ladders set up: firm/level base, clip/lash down, leaning at the correct angle, etc. • Work safely in and around trenches, elevated places and confined areas. • Lift heavy objects safely using correct procedures. • Apply good housekeeping practices at all times.	

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		Good housekeeping practices: clean/tidy work areas, removal/disposal of waste products, protect surfaces • Identify common hazard signs displayed in various areas. Various areas: on chemical containers; equipment; packages; inside buildings; in open areas and public spaces, etc.	
3	**Fire Safety** **Theory Duration** (hh:mm) 05:00 **Practical Duration** (hh:mm) 30:00 **Corresponding NOS Code** CSC/N1335	• Identify causes of fire accidents. • Recognise required fire extinguisher based on the type of fire. Types of fires: Class A: e.g. ordinary solid combustibles, such as wood, paper, cloth, plastic, charcoal, etc.; Class B: flammable liquids and gases, such as gasoline, propane, diesel fuel, tar, cooking oil, and similar substances; Class C: e.g. electrical equipment such as appliances, wiring, breaker panels, etc. (These categories of fires become Class A, B, and D fires when the electrical equipment that initiated the fire is no longer receiving electricity); Class D: combustible metals such as magnesium, titanium, and sodium (These fires burn at extremely high temperatures and require special suppression agents) • Use the various appropriate fire extinguishers on different types of fires correctly. • Interpret fire safety signs. • Inspect evacuation plan in case of fire. • Identify the location of assembly point, fire exit and fire alarm. • Follow reporting procedure in case of a fire. • Participate in fire safety drills at the workplace. • Demonstrate good housekeeping in order to prevent fire hazards.	Training kit (Trainer guide, Presentation), Class A,B,C and D fire extinguishers.
4	**Emergencies, rescue and first aid procedure** **Theory Duration** (hh:mm) 09:00 **Practical Duration** (hh:mm)	• Follow electrical safety procedures. • Use approved method to rescue a person from electrocution. • State the importance of first aid. • Identify the contents of a first aid kit. • Administer first aid in case of minor injuries, bleeding, burns, choking, electrical shock, poisoning, etc.	Training kit (Trainer guide, Presentation), First aid kit with all contents.

Sr. No.	Module	Key Learning Outcomes	Equipment Required
	18:00 **Corresponding NOS Code** CSC/N1335	• Demonstrate the artificial respiration and CPR process. • Follow correct method to move injured people and others during an emergency. • Explain stages of crisis and crisis management. • Participate in emergency procedures as per role. Emergency procedures: raising alarm, safe/efficient evacuation, correct means of escape, correct assembly point, roll call, correct return to work. • Write an accident/incident report or dictate a report to another person and send report to person responsible. Incident Report includes details of: name, date/time of incident, date/time of report, location, environment conditions, persons involved, sequence of events, injuries sustained, damage sustained, actions taken, witnesses, supervisor/manager notified.	
5	**Working effectively with others** **Theory Duration** (hh:mm) 20:00 **Practical Duration** (hh:mm) 60:00 **Corresponding NOS Code** CSC/N1336	• State various categories of people that one is required to communicate and co-ordinate within the organization. • Explain the importance of effective communication in the workplace. • Explain the importance of teamwork in organizational and individual success. • Describe various components of effective communication and active listening. • Describe the barriers to effective communication. • Provide and receive information to and from authorized persons accurately and within agreed timescale. • Give information to others clearly, at a pace and in a manner that helps them to understand. • Assist others in performing tasks in a positive and helpful manner, where required and possible. • Take measures to maximize effectiveness and efficiency in carrying out tasks by consulting with and assisting others. • Follow appropriate communication etiquette while working.	Training kit (Trainer guide, Presentation)

Sr. No.	Module	Key Learning Outcomes	Equipment Required
		Communication etiquette: do not use abusive language; use appropriate titles and terms of respect; do not eat or chew while talking (vice versa), use appropriate tone, pitch and language to convey politeness, assertiveness, care and professionalism, etc. • Apply active listening skills while interacting with others at work. • Explain the importance of ethics and discipline for professional success. • Describe common reasons for interpersonal conflict and ways of managing interpersonal conflict effectively. • Explain the importance of developing effective working relationships for professional success. • Display responsible and disciplined behaviors at the workplace. Disciplined behaviors: e.g. punctuality; completing tasks as per given time and standards; not gossiping and idling time; eliminating waste, honesty, etc. • Escalate grievances and problems to appropriate authority as per procedure to resolve them and avoid conflict.	
	Total Duration **Theory Duration 84:00** **Practical Duration 216:00**	**Unique Equipment Required:** CNC controlled Vertical Machining Centre(VMC) – 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 and D fire extinguishers, PPE, first aid kit with all contents.	

Grand Total Course Duration: **300 Hours, 0 Minutes**

*(This syllabus/ curriculum has been approved by **Capital Goods Skill Council)***

Trainer Prerequisites for Job role: "CNC Operator- Vertical Machining Centre" mapped to Qualification Pack: "CSC/Q0116 v1.0"

Sr. No.	Area	Details
1	**Description**	Operation of Computer Numerically Controlled (CNC) vertical machining centre (VMC), in order to perform machining operations on metal components, as per specifications provided.
2	**Personal Attributes**	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	**Minimum Educational Qualifications**	Diploma /Degree in Mechanical Engineering
4a	**Domain Certification**	Certified for Job Role: "CNC Operator- Vertical Machining Centre" mapped to QP: "CSC/Q0116, v1.0". Minimum accepted score is 80%
4b	**Platform Certification**	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%.
5	**Experience**	• 3-4 years of industry experience in the relevant field • 3-4 years of teaching experience

Criteria For Assessment Of Trainees

Job Role: CNC Operator - Vertical Machining Centre

Qualification Pack: CSC/Q0116

Sector Skill Council: Capital Goods Skill Council

Guidelines for Assessment

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. 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 theory part for each candidate at each examination/training center (as per assessment criteria below).
5. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criterion.
6. To pass the Qualification Pack , 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.

Total Marks: 300	**Compulsory NOS**			**Marks Allocation**	
Assessment outcomes	**Assessment Criteria for outcomes**	**Total Marks**	**Out of**	**Theory**	**Skills Practical**
CSC/N0116 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	100	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 workpieces/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. seek any necessary instruction/ training on the operation of the machine where appropriate		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-determined fixtures or work holding devices as per work instructions		3	1	2
	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 applicable to the process		4	1	3
	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
		Total	**100**	**25**	**75**
CSC/N1335 Use basic health and safety practices at the workplace	PC1.use protective clothing/equipment for specific tasks and work conditions	100	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		4	2	2
	PC6.state methods of accident prevention in the work environment of the job role		3	2	1
	PC7.state location of general health and safety equipment in the workplace		5	2	3
	PC8.inspect for faults, set up and safely use steps and ladders in general use		5	2	3
	PC9.work safely in and around trenches, elevated places and confined areas		5	2	3
	PC10.lift heavy objects safely using correct procedures		4	2	2
	PC11.apply good housekeeping practices at all times		5	2	3
	PC12.identify common hazard signs displayed in various areas		3	1	2
	PC13.retrieve and/or point out documents that refer to health and safety in the workplace		4	1	3
	PC14.use the various appropriate fire extinguishers on different types of fires correctly		4	1	3
	PC15.demonstrate rescue techniques applied during fire hazard		3	1	2
	PC16.demonstrate good housekeeping in order to prevent fire hazards		4	1	3
	PC17.demonstrate the correct use of a fire extinguisher		4	1	3
	PC18.demonstrate how to free a person from electrocution		4	1	3

	PC19.administer appropriate first aid to victims where required eg. in case of bleeding, burns, choking, electric shock, poisoning etc.		3	1	2
	PC20.demonstrate basic techniques of bandaging		4	1	3
	PC21.respond promptly and appropriately to an accident situation or medical emergency in real or simulated environments		3	1	2
	PC22.perform and organize loss minimization or rescue activity during an accident in real or simulated environments		3	1	2
	PC23.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
	PC24.demonstrate the artificial respiration and the CPR Process		3	2	1
	PC25.participate in emergency procedures		2	1	1
	PC26.complete a written accident/incident report or dictate a report to another person, and send report to person responsible		3	1	2
	PC27.demonstrate correct method to move injured people and others during an emergency		3	1	2
		Total	**100**	**37**	**63**
CSC/N1336 Work effectively with others	PC1.accurately receive information and instructions from the supervisor and fellow workers, getting clarification where required	100	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
	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
		Total	**100**	**30**	**70**