



## Course Outcome Summary

### 31420315 CNC Production Mill-Operation

#### Course Information

<b>Description:</b>	Operation of CNC (Computer Numerical Control) machining centers includes calling up programs, loading and unloading parts, inspection, and the recognition of tool wear. Procedural processes, inspection of parts, and the use of inspection sheets and guides will be covered.
<b>Career Cluster:</b>	Manufacturing
<b>Instructional Level:</b>	Technical Diploma Courses
<b>Total Credits:</b>	1.00
<b>Total Hours:</b>	36.00
<b>Purpose/Goals:</b>	Operate CNC mills and machining centers for production.
<b>Prerequisites:</b>	31420302 Blueprint Reading 31420314 Machining: Intro to Machining 31804334 Manufacturing Math

## Learner Supplies

Safety glasses with side eye protection that meet Z87 OSHA guidelines. Required.

Proper work boots - \$35.00-75.00. Required.

Scientific calculator (recommend T1-36x Solar). Required.

## Program Outcomes

### 1. MACH 1. Apply basic safety practices in the machine shop

Type TSA Status Active

#### Summative Assessment Strategies

- 1.1. in a performance demonstration in the machine shop or lab
- 1.2. in a written examination

#### Criteria

- 1.1. Demonstrate safety procedures
- 1.2. Operate machine with all required guards in place
- 1.3. Maintain clean and organized work environment
- 1.4. Wear appropriate clothing and Personal Protective Equipment (PPE)
- 1.5. Explain proper lock-out tag-out procedures

### 2. MACH 2. Interpret industrial/engineering drawings

Type TSA Status Active

#### Summative Assessment Strategies

- 2.1. in a performance demonstration

#### Criteria

- 2.1. Interpret orthographic projections
- 2.2. Interpret lines, symbols, standards, and notations
- 2.3. Interpret a Bill of Materials
- 2.4. Interpret a title block
- 2.5. Determine location of part features according to established specifications
- 2.6. Calculate tolerances according to established specifications
- 2.7. Develop drawings that follow view projection standards
- 2.8. Interpret Geometric Dimensioning and Tolerancing

### 3. MACH 3. Apply precision measuring methods to part inspection

Type TSA Status Active

#### Summative Assessment Strategies

- 3.1. in a performance demonstration

#### Criteria

- 3.1. Select correct measuring tool for job requirements
- 3.2. Demonstrate care of precision measuring equipment according to established procedures
- 3.3. Convert English/metric measurements
- 3.4. Use standard industry measurement terminology
- 3.5. Perform precision measurement according to established procedures
- 3.6. Complete an inspection document to verify print specifications
- 3.7. Use computer aided metrology

### 4. MACH 5. Perform programming, set-up and operation of CNC Machine Tools

Type TSA Status Active

### Summative Assessment Strategies

- 4.1. in a performance demonstration

### Criteria

- 4.1. Write basic programs for specified CNC machine tools according to EIA-ISO standards
- 4.2. Load the correct program into the machine
- 4.3. Verify the accuracy of the CNC program
- 4.4. Verify work and tool offsets
- 4.5. Execute program
- 4.6. Adjust speeds and feeds to optimize CNC machining conditions

## Course Competencies

### 1. Identify various types of CNC machining centers

<i>Domain</i>	<i>Cognitive</i>	<i>Level</i>	<i>Knowledge</i>	<i>Status</i>	<i>Active</i>
---------------	------------------	--------------	------------------	---------------	---------------

#### Assessment Strategies

- 1.1. In the classroom, lab, or shop setting
- 1.2. Using interactive computer software and/or actual CNC machine tools
- 1.3. In written and applied assignments
- 1.4. Individually
- 1.5. On tests and quizzes
- 1.6. Given diagrams, materials, and all available shop equipment and supplies

#### Criteria

*Performance will be satisfactory when:*

- 1.1. learner lists the common brands of CNC machining centers
- 1.2. learner matches brands to control models
- 1.3. learner correctly identifies brands and controllers in the shop or lab
- 1.4. learner participates in lab or shop orientation for machining centers
- 1.5. learner participates in lab or shop discussion of CNC machining center features
- 1.6. learner successfully completes MasterTask CNC Mills Module 1 interactive test
- 1.7. learner completes all activities with a minimum of 70% accuracy
- 1.8. learner scores a minimum of 70% on assignments, tests, and quizzes

#### Learning Objectives

- 1.a. Identify CNC machining center brands
- 1.b. Describe control models within machine brands
- 1.c. Explain differences in CNC machining center features for various models
- 1.d. Identify CNC machining center workpiece holding and loading mechanisms
- 1.e. Identify CNC machining center tool handling and retrieval mechanisms on CNC machining centers

### 2. Describe the coordinate movements of CNC machining centers

<i>Domain</i>	<i>Cognitive</i>	<i>Level</i>	<i>Comprehension</i>	<i>Status</i>	<i>Active</i>
---------------	------------------	--------------	----------------------	---------------	---------------

#### Assessment Strategies

- 2.1. In the classroom, lab, or shop setting
- 2.2. Using interactive computer software and/or actual CNC machine tools
- 2.3. In written and applied assignments
- 2.4. Individually
- 2.5. On tests and quizzes
- 2.6. Given diagrams, models, materials, and all available shop equipment and supplies

#### Criteria

*Performance will be satisfactory when:*

- 2.1. learner accurately completes a diagram showing CNC machining center axis coordinate movements
- 2.2. learner correctly demonstrates relevant axes movements on machine axes model
- 2.3. learner correctly identifies PRZ and machine home locations on a part diagram or print
- 2.4. learner correctly demonstrates tool movement relative to coordinate system using models

- 2.5. learner accurately diagrams part reference zero and machine home locations
- 2.6. learner successfully completes MasterTask CNC Mills Module 2 interactive test
- 2.7. learner successfully completes MasterTask CNC Mills Module 3 interactive test
- 2.8. learner successfully completes MasterTask CNC Mills Module 4 interactive test
- 2.9. learner successfully completes MasterTask CNC Mills Module 5 interactive test
- 2.10. learner completes all activities with a minimum of 70% accuracy
- 2.11. learner scores a minimum of 70% on assignments, tests, and quizzes

**Learning Objectives**

- 2.a. Describe safety procedures for CNC machining centers
- 2.b. Describe basic operating principles of CNC machining centers
- 2.c. Describe CNC machining center workpiece holding and loading mechanisms
- 2.d. Describe automatic tool handling and retrieval mechanisms on CNC machining centers
- 2.e. Describe CNC machining center axis movements relative to the Cartesian coordinate system
- 2.f. Determine position of signed numbers on a coordinate grid system
- 2.g. Describe the A, B, and C axes movements of a CNC machining center relative to the coordinate system
- 2.h. Describe the machine zero or home location on the CNC machining center
- 2.i. Describe the part zero reference location on the CNC machining center
- 2.j. Differentiate PRZ and Machine Zero
- 2.k. Describe a typical application of PRZ relative to machine zero
- 2.l. Explain tool movement control relative to the coordinate system
- 2.m. Describe the tool change position relative to Home and PRZ

**3. Identify common CNC machining center programming methods**

<i>Domain</i>	<i>Cognitive</i>	<i>Level</i>	<i>Comprehensi on</i>	<i>Status</i>	<i>Active</i>
---------------	------------------	--------------	---------------------------	---------------	---------------

**Assessment Strategies**

- 3.1. In the classroom, lab, or shop setting
- 3.2. Using interactive computer software and/or actual CNC machine tools
- 3.3. In written and applied assignments
- 3.4. Individually
- 3.5. On tests and quizzes
- 3.6. Given prints, diagrams, materials, and all available shop equipment and supplies

**Criteria**

*Performance will be satisfactory when:*

- 3.1. learner correctly identifies types of controls on specific CNC milling machines in the machine tool lab or shop
- 3.2. learner describes the differences in programming requirements for specific CNC milling machines in the machine tool lab or shop
- 3.3. learner correctly identifies basic EIA/ISO codes on CNC machining center display screen
- 3.4. learner correctly selects tools for CNC milling machines for given applications
- 3.5. learner successfully completes MasterTask CNC Mills Module 7 interactive test
- 3.6. learner completes all activities with a minimum of 70% accuracy
- 3.7. learner scores a minimum of 70% on assignments, tests, and quizzes

**Learning Objectives**

- 3.a. Identify various CNC machining center models of controls
- 3.b. Identify common languages used in CNC mill programming
- 3.c. Differentiate conversational controls and EIA controls on CNC machining centers
- 3.d. Describe various machining operations performed in CNC machining centers
- 3.e. Identify tools for various machining operations performed in CNC machining centers
- 3.f. Identify universal basic function EIA programming codes
- 3.g. Identify the universally common elements of a conversational program
- 3.h. Describe the difference between online and offline programming

**4. Operate controls on CNC machining centers**

<i>Domain</i>	<i>Psychomotor</i>	<i>Level</i>	<i>Practice</i>	<i>Status</i>	<i>Active</i>
---------------	--------------------	--------------	-----------------	---------------	---------------

**Assessment Strategies**

- 4.1. In the classroom, lab, or shop setting
- 4.2. Using interactive computer software and/or actual CNC machine tools
- 4.3. In written and applied assignments
- 4.4. Individually
- 4.5. On tests and quizzes
- 4.6. Given prints, diagrams, materials, and all available shop equipment and supplies

**Criteria**

*Performance will be satisfactory when:*

- 4.1. learner locates and correctly identifies the main controls on CNC milling machines in the lab or shop
- 4.2. learner locates and correctly identifies CNC control components on CNC milling machines in the machine tool lab or shop
- 4.3. learner sequentially lists the steps required to turn on each type of CNC milling machine in the machine tool lab or shop
- 4.4. learner correctly demonstrates the steps required to turn on each type of CNC milling machine in the machine tool lab or shop
- 4.5. learner correctly navigates between menus, chapters, and pages on each type of CNC machining center control in the machine tool lab or shop
- 4.6. learner correctly demonstrates the use of cursors and control buttons on CNC control monitors in the machine tool lab or shop
- 4.7. learner correctly demonstrates the use of manual jog controls on each type of CNC milling machine in the machine tool lab or shop
- 4.8. learner correctly describes the purpose of each machine control button and the emergency stop
- 4.9. learner correctly describes typical information found on each page of the CNC machining center monitor
- 4.10. learner successfully completes MasterTask CNC Mills Module 9 interactive test
- 4.11. learner successfully completes MasterTask CNC Mills Module 10 interactive test
- 4.12. learner successfully completes MasterTask CNC Mills Module 27 interactive test
- 4.13. learner completes all activities with a minimum of 70% accuracy
- 4.14. learner scores a minimum of 70% on assignments, tests, and quizzes

**Learning Objectives**

- 4.a. Identify main controls on various CNC machining centers
- 4.b. Identify the basic CNC control components on various machines
- 4.c. Explain the function of each of the components on a CNC machining center control
- 4.d. List the steps required to turn on CNC machining centers
- 4.e. Demonstrate the procedure to turn on and home CNC machines
- 4.f. Identify mode selection controls
- 4.g. Describe the function of each of the modes
- 4.h. Discuss typical variations found on different brands and types of CNC machining centers
- 4.i. Demonstrate the navigation of menus, chapters, and pages on CNC control monitors
- 4.j. Demonstrate the navigation between position, program, and offset pages on CNC control monitors
- 4.k. Describe the information found on each page of the CNC control monitor
- 4.l. Demonstrate the use of cursors and control buttons on CNC control monitors
- 4.m. Explain the use of the Emergency Stop button on CNC machining centers
- 4.n. Describe the variations between Handle Jog controls on various machines
- 4.o. Demonstrate the use of Handle Jog controls on various machines

**5. Call up programs on CNC machining centers**

<i>Domain</i>	<i>Psychomotor</i>	<i>Level</i>	<i>Practice</i>	<i>Status</i>	<i>Active</i>
---------------	--------------------	--------------	-----------------	---------------	---------------

**Assessment Strategies**

- 5.1. In the classroom, lab, or shop setting
- 5.2. Using interactive computer software and/or actual CNC machine tools
- 5.3. In written and applied assignments
- 5.4. Individually
- 5.5. On tests and quizzes
- 5.6. Given prints, diagrams, materials, and all available shop equipment and supplies

**Criteria**

*Performance will be satisfactory when:*

- 5.1. learner sequentially lists the steps for calling up programs on various types of CNC milling machines
- 5.2. learner correctly identifies the buttons and modes for calling up programs on various CNC milling machines in the machine tool lab or shop
- 5.3. learner sequentially lists the steps required for showing graphical plotting of programs
- 5.4. learner correctly demonstrates the steps for calling up programs in conversational control CNC milling machines
- 5.5. learner correctly demonstrates the steps for calling up programs in EIA/ISO controlled CNC machining centers
- 5.6. learner correctly verifies programs in the graphical interface of conversational controlled CNC milling machines
- 5.7. learner correctly verifies programs in EIA/ISO controlled CNC machining centers
- 5.8. learner successfully completes MasterTask CNC Mills Module 76 interactive test
- 5.9. learner completes all activities with a minimum of 70% accuracy
- 5.10. learner scores a minimum of 70% on assignments, tests, and quizzes

#### Learning Objectives

- 5.a. List the steps for calling up programs on various CNC machining centers
- 5.b. Identify the buttons on the CNC machine control for calling up programs
- 5.c. Demonstrate the procedure for calling up programs on CNC machining centers
- 5.d. Call up programs on conversational and EIA controlled CNC machining centers
- 5.e. Verify programs in graphical interface

### 6. Perform scheduled machine maintenance

<i>Domain</i>	<i>Psychomotor</i>	<i>Level</i>	<i>Practice</i>	<i>Status</i>	<i>Active</i>
---------------	--------------------	--------------	-----------------	---------------	---------------

#### Assessment Strategies

- 6.1. In the classroom, lab, or shop setting
- 6.2. Using interactive computer software and/or actual CNC machine tools
- 6.3. In written and applied assignments
- 6.4. Individually
- 6.5. On tests and quizzes
- 6.6. Given diagrams, logs, materials, and all available shop equipment and supplies

#### Criteria

*Performance will be satisfactory when:*

- 6.1. learner correctly locates coolant tanks on all CNC milling machines in the machine tool lab or shop
- 6.2. learner states the correct mixture and concentration for coolant tank fluid
- 6.3. learner correctly identifies situations when the coolant tank needs to be filled
- 6.4. learner correctly demonstrates the process of filling the coolant tank
- 6.5. learner correctly locates and identifies the way oil system components on all CNC milling machines in the machine tool lab or shop
- 6.6. learner correctly demonstrates the process for fluid level maintenance after machine warm up
- 6.7. learner maintains and completes a maintenance log during the course
- 6.8. learner successfully completes MasterTask CNC Mills Module 27 interactive test
- 6.9. learner completes all activities with a minimum of 70% accuracy
- 6.10. learner scores a minimum of 70% on assignments, tests, and quizzes

#### Learning Objectives

- 6.a. Identify coolant tank locations
- 6.b. List the components of CNC machining center coolant systems
- 6.c. Describe how coolant and chips are removed from the machining area of a CNC machining center
- 6.d. Describe procedures for coolant tank inspection
- 6.e. Describe the process for filling coolant tanks
- 6.f. Describe the components of the hydraulic system
- 6.g. Describe the procedures for inspecting hydraulic systems
- 6.h. Describe the lubrication system components and maintenance procedures
- 6.i. Describe the process for maintaining fluid levels after machine warm up
- 6.j. Discuss the use of lock-out procedures during maintenance
- 6.k. Explain the procedures for checking and correcting system deficiencies
- 6.l. Explain the function of automatic maintenance check systems
- 6.m. Perform system checks and maintenance

## 7. Set up tools in CNC machining centers

*Domain Psychomotor Level Practice Status Active*

### Assessment Strategies

- 7.1. In the classroom, lab, or shop setting
- 7.2. Using interactive computer software and/or actual CNC machine tools
- 7.3. In written and applied assignments
- 7.4. Individually
- 7.5. On tests and quizzes
- 7.6. Given prints, specification sheets, and all available shop equipment and supplies

### Criteria

*Performance will be satisfactory when:*

- 7.1. learner observes all safe operating procedures when setting up and changing tools on CNC milling machines
- 7.2. learner correctly identifies and selects tools for CNC milling machines from tool list specifications
- 7.3. learner correctly uses CNC machining center controls to rotate carousel
- 7.4. learner correctly demonstrates ability to control the direction of carousel rotation
- 7.5. learner correctly demonstrates the process for changing tools in CNC milling machines with manual tool changers
- 7.6. learner correctly demonstrates the process for changing and loading tools in CNC machining centers with automatic tool changers
- 7.7. learner successfully completes MasterTask CNC Mills Module 7 interactive test
- 7.8. learner successfully completes MasterTask CNC Mills Module 8 interactive test
- 7.9. learner successfully completes MasterTask CNC Mills Module 40 interactive test
- 7.10. learner successfully completes MasterTask CNC Mills Module 47 interactive test
- 7.11. learner successfully completes MasterTask CNC Mills Module 48 interactive test
- 7.12. learner completes all activities with a minimum of 70% accuracy
- 7.13. learner scores a minimum of 70% on assignments, tests, and quizzes

### Learning Objectives

- 7.a. Identify the various types of cutters, tools and tool holders for CNC machining centers
- 7.b. Select tools and holders for CNC machining centers
- 7.c. Demonstrate the procedure for changing tools in CNC machining centers without tool carousels
- 7.d. Identify control buttons to move or index the tool carousel
- 7.e. Describe the safe location for changing tools
- 7.f. Demonstrate rotating the carousel to index tool positions
- 7.g. Demonstrate the procedure for changing tools in CNC machining centers
- 7.h. Interpret a tool drawing to determine axis direction relative to spindle centerline
- 7.i. Demonstrate the procedures for establishing and setting tool length offsets

## 8. Set up work in CNC machining centers

*Domain Psychomotor Level Practice Status Active*

### Assessment Strategies

- 8.1. In the classroom, lab, or shop setting
- 8.2. Using interactive computer software and/or actual CNC machine tools
- 8.3. In written and applied assignments
- 8.4. Individually
- 8.5. On tests and quizzes
- 8.6. Given prints, stock, and all available shop equipment and supplies

### Criteria

*Performance will be satisfactory when:*

- 8.1. learner correctly demonstrates the procedures to start up and home CNC milling machines in the machine tool lab or shop
- 8.2. learner recognizes overtravel alarms within time period specified and participates in discussion to solve the problem
- 8.3. learner observes safety procedures 100% of the time while setting up work in CNC milling machines

- 8.4. learner correctly demonstrates the process of setting up and securing work in conversationally controlled CNC milling machines
- 8.5. learner correctly demonstrates the process of setting up and securing work in automatic CNC machining centers
- 8.6. learner correctly demonstrates the procedures for using stock stops for production machining
- 8.7. learner correctly demonstrates the procedures for setting up work in fixtures
- 8.8. learner successfully completes MasterTask CNC Mills Module 11 interactive test
- 8.9. learner successfully completes MasterTask CNC Mills Module 51 interactive test
- 8.10. learner completes all activities with a minimum of 70% accuracy
- 8.11. learner scores a minimum of 70% on assignments, tests, and quizzes

**Learning Objectives**

- 8.a. Describe the procedures for homing various CNC machining centers
- 8.b. Demonstrate the procedures for homing various CNC machining centers
- 8.c. Describe the conditions that cause an overtravel alarm
- 8.d. Demonstrate the process of securing work in CNC machining centers
- 8.e. Demonstrate the procedures for using stock stops for production machining
- 8.f. Demonstrate the procedures for establishing and setting work coordinates

**9. Run programs in CNC machining centers**

<i>Domain</i>	<i>Psychomotor</i>	<i>Level</i>	<i>Practice</i>	<i>Status</i>	<i>Active</i>
---------------	--------------------	--------------	-----------------	---------------	---------------

**Assessment Strategies**

- 9.1. In the classroom, lab, or shop setting
- 9.2. Using interactive computer software and/or actual CNC machine tools
- 9.3. In written and applied assignments
- 9.4. Individually
- 9.5. On tests and quizzes
- 9.6. Given prints, diagrams, stock, and all available shop equipment and supplies

**Criteria**

*Performance will be satisfactory when:*

- 9.1. learner observes safety procedures 100% of the time while running CNC milling machines
- 9.2. learner creates an accurate checklist for the steps required to setup and perform a production run in CNC milling machines
- 9.3. learner demonstrates ability to call up programs in each type of CNC milling machine in the machine tool lab or shop
- 9.4. learner correctly follows standard procedures for setting up work and tools in the CNC milling machines
- 9.5. learner correctly locates offset screens in each type of CNC milling machine in the machine tool lab or shop
- 9.6. learner correctly demonstrates ability to set tool to Z top of part
- 9.7. learner correctly demonstrates ability to set tool X and Y locations for parts
- 9.8. learner correctly demonstrates the ability to locate button on machine control to run programs
- 9.9. learner correctly demonstrates ability to start and run programs
- 9.10. learner correctly demonstrates procedures for checking and removing parts from the CNC milling machines after program has ran
- 9.11. learner demonstrates production steps to continue a production part run
- 9.12. learner successfully completes MasterTask CNC Mills Module 77 interactive test
- 9.13. learner completes all activities with a minimum of 70% accuracy
- 9.14. learner scores a minimum of 70% on assignments, tests, and quizzes

**Learning Objectives**

- 9.a. Practice safe operating procedures for running CNC machining centers
- 9.b. List the procedures for setting up and performing a production run on CNC machining centers
- 9.c. Call up programs that will be run in CNC machining centers
- 9.d. Follow procedures for securing work in CNC machining centers
- 9.e. Demonstrate how to locate offset screens using various machine controls
- 9.f. Set tool length and diameter offsets
- 9.g. Set work coordinate offsets
- 9.h. Explain the importance of using coolant in cutting operations on the CNC machining center
- 9.i. Run programs in various CNC machining centers

9.j. Perform production steps required after first part is ran

**10. Perform quality inspections on CNC milled parts**

*Domain Psychomotor Level Practice Status Active*

**Assessment Strategies**

- 10.1. In the classroom, lab, or shop setting
- 10.2. Using interactive computer software and/or actual CNC machine tools
- 10.3. In written and applied assignments
- 10.4. Individually
- 10.5. On tests and quizzes
- 10.6. Given prints, diagrams, pictures, inspection sheets, materials, and all available shop equipment and supplies

**Criteria**

*Performance will be satisfactory when:*

- 10.1. learner observes safety procedures 100% of the time while inspecting parts in CNC milling machines
- 10.2. learner uses specifications on documents to correctly identify part dimensions to measure and inspect
- 10.3. learner uses specifications on documents to correctly identify part finishes to inspect
- 10.4. learner correctly identifies the frequency with which to inspect parts
- 10.5. learner accurately performs inspections on parts
- 10.6. learner correctly follows directions for inspection frequency
- 10.7. learner accurately records inspection results on documentation sheets
- 10.8. learner correctly identifies problems with part quality
- 10.9. learner follows the correct procedures for reporting part quality problems
- 10.10. learner successfully completes MasterTask CNC Mills Module 37 interactive test
- 10.11. learner completes all activities with a minimum of 70% accuracy
- 10.12. learner scores a minimum of 70% on assignments, tests, and quizzes

**Learning Objectives**

- 10.a. Analyze part prints or specification to determine part dimensions to inspect
- 10.b. Demonstrate safe procedures for inspecting parts while still in the CNC machining centers
- 10.c. Perform inspections on parts after machining per specified frequency
- 10.d. Explain the concepts of locational, roughness, and size tolerances
- 10.e. Identify quality defects in machined parts
- 10.f. Record inspection results
- 10.g. Explain the procedure for reporting problems with part quality

**11. Recognize problems related to CNC machine operation**

*Domain Cognitive Level Evaluation Status Active*

**Assessment Strategies**

- 11.1. In the classroom, lab, or shop setting
- 11.2. Using interactive computer software and/or actual CNC machine tools
- 11.3. In written and applied assignments
- 11.4. Individually or in groups
- 11.5. On tests and quizzes
- 11.6. Given diagrams, materials, and all available shop equipment and supplies

**Criteria**

*Performance will be satisfactory when:*

- 11.1. learner observes safety procedures 100% of the time while running CNC milling machines
- 11.2. learner accurately lists the processes required for efficiently finding and eliminating quality problems
- 11.3. learner correctly follows flow chart to isolate potential problem sources
- 11.4. learner correctly identifies problems with part quality
- 11.5. learner correctly identifies problems with part quality as a result of chatter
- 11.6. learner correctly identifies machine vibration sounds
- 11.7. learner correctly demonstrates the use of override controls to reduce or correct vibration problems
- 11.8. learner correctly identifies finish problems associated with tool wear, tool failure, or workholding problems

- 11.9. learner correctly lists potential causes of broken cutter inserts and suggests preventative actions
- 11.10. learner participates in discussion of operator responsibilities
- 11.11. learner follows specified procedures for reporting problems during machining
- 11.12. learner successfully completes MasterTask CNC Mills Module 38 interactive test
- 11.13. learner successfully completes MasterTask CNC Mills Module 39 interactive test
- 11.14. learner completes all activities with a minimum of 70% accuracy
- 11.15. learner scores a minimum of 70% on assignments, tests, and quizzes

**Learning Objectives**

- 11.a. Define the machine operator's role in identifying quality defects
- 11.b. Identify chatter sounds between the workpiece and tool
- 11.c. Identify the condition that chatter creates on the workpiece surface
- 11.d. Follow a logical path through likely problem sources to isolate areas to investigate
- 11.e. Describe potential problem sources related to quality problems
- 11.f. Describe the steps required to correct problems by making an adjustment and resuming production
- 11.g. Explain common causes of chatter
- 11.h. Explain ways to correct vibration using overrides
- 11.i. Associate chatter sources with part or tool conditions
- 11.j. Identify causes of finish problems other than from vibration
- 11.k. Explain the relationship between tool war and rough or finish operations
- 11.l. Describe the operator's responsibility after discovering machining problems

**12. Change CNC machining center tools and inserts**

*Domain Psychomotor Level Practice Status Active*

**Assessment Strategies**

- 12.1. In the classroom, lab, or shop setting
- 12.2. Using interactive computer software and/or actual CNC machine tools
- 12.3. In written and applied assignments
- 12.4. Individually
- 12.5. On tests and quizzes
- 12.6. Given diagrams, materials, and all available shop equipment and supplies

**Criteria**

*Performance will be satisfactory when:*

- 12.1. learner correctly identifies inserts that are damaged or worn and need to be changed
- 12.2. learner correctly identifies cutting tools that are damaged or worn and must be replaced
- 12.3. learner selects the correct insert shape and style for replacement
- 12.4. learner correctly demonstrates the procedure for changing inserts
- 12.5. learner selects the correct cutting tool for replacement
- 12.6. learner correctly demonstrates the procedure for changing cutting tools
- 12.7. learner accurately completes documentation stating the insert or tool that was changed and the likely cause of the damage
- 12.8. learner demonstrates the correct procedures for adjusting offsets in the CNC milling machine control
- 12.9. learner follows correct procedures for notifying specified supervisor or setup person after changing inserts or tools
- 12.10. learner successfully completes MasterTask CNC Mills Module 41 interactive test
- 12.11. learner completes all activities with a minimum of 70% accuracy
- 12.12. learner scores a minimum of 70% on assignments, tests, and quizzes

**Learning Objectives**

- 12.a. Explain the procedure for changing tools and inserts in the CNC machining centers
- 12.b. Perform inspections of tooling and inserts
- 12.c. Identify the effect of damaged or worn inserts on workpiece finish
- 12.d. Identify damaged or worn inserts
- 12.e. Explain the most likely causes of insert failure
- 12.f. Demonstrate the process of changing inserts
- 12.g. Adjust offsets as needed
- 12.h. Explain operator responsibility after changing inserts