

Western Technical College

31444306 Programming/CAM for CNC Turning

Course Outcome Summary

Course Information

Description	This course will include instruction and practice in writing programs for CNC turning machines. Instruction will begin with manually writing G&M code programs and advance to creating programs with CAM software
Career Cluster	Manufacturing
Instructional Level	One-Year Technical Diploma
Total Credits	2
Total Hours	72

Textbooks

Mastercam X8 Training Guide – Lathe. Copyright 2014. Manton, Matthew. Publisher: Cominstructor.com. **ISBN-13:** 978-1-927359-58-7. Required.

420-310 CNC Programming Manual Machine Tool Technology. Western. Publisher: Western. Required.

Learner Supplies

Safety glasses with side eye protection that meet Z87 OSHA guidelines. **Vendor:** Campus Shop. Required.

Proper footwear - \$35.00-75.00. **Vendor:** To be discussed in class. Required.

Scientific calculator (recommend T1-36x Solar). **Vendor:** Campus Shop. Required.

Program Outcomes

1. MACH 1. Apply basic safety practices in the machine shop
2. MACH 2. Interpret industrial/engineering drawings
3. MACH 3. Apply precision measuring methods to part inspection
4. MACH 5. Perform programming, set-up and operation of CNC Machine Tools

Course Competencies

1. **Associate the Cartesian coordinate system with CNC turning center axes.**

Assessment Strategies

- 1.1. Applied assignments
- 1.2. Tests & quizzes

1.3. Project

Criteria

You will know you are successful when

- 1.1. you select correct CNC turning machine axis when plotting coordinates.
- 1.2. you use prints to plot coordinate points for CNC turning centers.
- 1.3. you incorporate the three Z positions appropriately into programs.
- 1.4. you select the correct relationship to part zero reference for X and Y coordinates in programs.

Learning Objectives

- 1.a. Discuss the purpose of the Cartesian coordinate system in CNC turning center machining.
- 1.b. Identify coordinate axes of CNC lathes and turning centers.
- 1.c. Describe the three Z position relationships between the workpiece and tool.
- 1.d. Explain the X and Y coordinate relationships to the part zero reference location.
- 1.e. Locate coordinate points graphically for CNC turning center axes.

2. Apply terminology associated with CNC turning center programming.

Assessment Strategies

- 2.1. Applied assignments
- 2.2. Tests & quizzes
- 2.3. Project

Criteria

Performance will be satisfactory when:

- 2.1. learner participates in classroom discussion on terminology related to CNC machining
- 2.2. learner scores 70% or greater on terminology quiz
- 2.3. learner uses the correct terms for CNC turning center system components
- 2.4. learner correctly identifies print symbols as they relate to CNC machining
- 2.5. learner correctly describes the function of CNC general preparatory codes for turning centers
- 2.6. learner correctly describes the function of miscellaneous CNC codes for turning centers
- 2.7. learner interprets prints to write CNC turning programs
- 2.8. learner selects appropriate tools for CNC turning machine processes
- 2.9. learner describes CNC turning machine codes other than G and M codes
- 2.10. assignments have accuracy of 70% or higher

Learning Objectives

- 2.a. Identify terms related to CNC turning machines.
- 2.b. Describe CNC turning program word address terms.
- 2.c. Explain G and M code terms related to CNC turning center programming.
- 2.d. Identify print terms related to CNC machining.
- 2.e. Differentiate tooling terms as they relate to CNC turning centers.

3. Classify tooling for CNC turning centers.

Assessment Strategies

- 3.1. Applied assignments
- 3.2. Tests & quizzes
- 3.3. Project

Criteria

Performance will be satisfactory when:

- 3.1. learner correctly identifies the types of face and end mills used in CNC milling machines
- 3.2. learner correctly identifies the types of hole cutting tools used in milling operations
- 3.3. learner correctly identifies tools used inside holes in milling operations
- 3.4. learner accurately recognizes tool wear
- 3.5. learner differentiates types of materials used for cutting tools
- 3.6. learner correctly describes the purpose of various materials used for cutting tools
- 3.7. learner calculates correct speeds and feeds for various tool materials and workpiece material
- 3.8. learner explains the benefits and disadvantages of climb and conventional machining as they relate to CNC milling machines

- 3.9. learner correctly describes the types of cutting fluids used in CNC operations
- 3.10. learner explains how cutting fluids are selected for CNC milling operations
- 3.11. learner determines correct spindle rotation based on tooling
- 3.12. assignments are completed on time and have accuracy of 70% or better
- 3.13. Quizzes and tests have accuracy of 70% or better

Learning Objectives

- 3.a. Identify CNC turning machine tooling.
- 3.b. Select appropriate tools for hole operations.
- 3.c. Select appropriate tools for turning operations.
- 3.d. Describe types of materials used for cutting tools.
- 3.e. Calculate speeds and feeds for CNC turning applications.
- 3.f. Explain the purpose of cutting fluids in CNC turning applications.

4. Write basic programs with G and M codes for CNC lathes or turning centers.

Assessment Strategies

- 4.1. Applied assignments
- 4.2. Tests & quizzes
- 4.3. Project

Criteria

Performance will be satisfactory when:

- 4.1. learner correctly describes the three basic sections of a CNC machining center program
- 4.2. learner develops a start sequence format based on class lessons
- 4.3. learner uses start sequence correctly in all programs written
- 4.4. learner develops an ending sequence format based on class lessons
- 4.5. learner uses ending sequence in all programs written
- 4.6. learner writes absolute positioning linear interpolation program from part print
- 4.7. learner writes linear interpolation name program using absolute positioning
- 4.8. learner writes absolute positioning circular interpolation program from part print
- 4.9. learner writes circular interpolation name program using absolute positioning
- 4.10. learner incorporates Z position moves in programs
- 4.11. learner uses rapid moves for Zc movements in programs
- 4.12. learner finds and corrects errors in programs
- 4.13. name programs are proofed to run in CNC machining centers without errors
- 4.14. name programs are accurate enough to run in CNC machining centers
- 4.15. name programs are ran in CNC machining centers

Learning Objectives

- 4.a. Incorporate G and M code in programs.
- 4.b. Write program start sequences for CNC turning centers.
- 4.c. Write linear interpolation programs for CNC turning centers.
- 4.d. Write circular interpolation programs for CNC turning centers.
- 4.e. Write program ending sequence for CNC turning centers.
- 4.f. Write absolute positioning programs for CNC turning centers.
- 4.g. Write incremental positioning programs for CNC turning centers.
- 4.h. Explain the parts of a CNC turning center program.

5. Create a working program using CAM software.

Assessment Strategies

- 5.1. Applied assignments
- 5.2. Tests & quizzes
- 5.3. Project

6. Write multiple function programs for CNC turning centers.

Assessment Strategies

- 6.1. Applied assignments
- 6.2. Tests & quizzes
- 6.3. Project

Criteria

You will know you are successful when

- 6.1. learner writes programs using tool nose radius compensation
- 6.2. learner writes programs using G code cutter compensation
- 6.3. learner enters cutter compensation offsets in machine tool per program specifications
- 6.4. learner incorporates at least three tool changes in programs for CNC turning centers
- 6.5. learner incorporates at least two canned cycles in programs for CNC turning centers
- 6.6. learner uses G70 and G71 machine cycles in CNC turning center programs
- 6.7. learner proofs multiple function programs in graphical simulation
- 6.8. learner identifies and corrects program errors
- 6.9. multiple function programs are accurate enough to run in CNC turning centers
- 6.10. multiple function programs are ran in CNC turning centers
- 6.11. multiple function programs have accuracy of 90% or higher
- 6.12. assignments have accuracy of 80% or higher

Learning Objectives

- 6.a. Write CNC turning center programs with multiple tool changes.
- 6.b. Write CNC turning center programs using tool nose radius compensation.
- 6.c. Write CNC turning center programs that include canned cycles.
- 6.d. Write CNC turning center programs that include G71 and G70 machine cycles .