Western Technical College

31420360 CNC/Machining: Capstone

Course Outcome Summary

Course Information

Description	This course will provide additional practice on various types of CNC (Computer Numerical Control) machines and emphasize team projects.
Career Cluster	Manufacturing
Instructional Level	Technical Diploma Courses
Total Credits	2.00
Total Hours	72.00

Types of Instruction

Instruction Type	Credits/Hours
Lecture	1 CR / 36 HR
Lab	1 CR / 36 HR

Course History

Last Approval Date	5/4/2016

Purpose/Goals

To provide time and instruction for additional pratice on all types of Manual and CNC machines in team environment.

Pre/Corequisites

Prerequisite   Corequisite(s): 31420323 CNC Lathe Setup; 31420322 CNC Lathe Programming-Intermediate or 31420326 CNC Mill Setup; 31420420320 CNC Mill Programming

Textbooks

No textbook required.

Learner Supplies

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

Proper work boots - $35.00-75.00. **Vendor:** To be discussed in class. Required.

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

Three-ring binder. **Vendor:** Campus Shop. Required.

Clipboard. **Vendor:** Campus Shop. Required.

Pens/Pencils. **Vendor:** Campus Shop. Required.

Core Abilities

1. **Apply mathematical concepts.**
Status   *Active*

2. **Demonstrate ability to think critically.**
Status   *Active*

3. **Demonstrate ability to value self and work ethically with others in a diverse population.**
Status   *Active*

4. **Make decisions that incorporate the importance of sustainability.**
Status   *Active*

5. **Transfer social and natural science theories into practical applications.**
Status   *Active*

6. **Use effective communication skills.**
Status   *Active*

7. **Use technology effectively.**
Status   *Active*

Program Outcomes

1. **MACH 1. Apply basic safety practices in the machine shop**
Type   *TSA*   *Status*   *WIP*

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*   *WIP*

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*   *WIP*

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 4. Perform basic machine tool equipment set-up and operation
Type   *TSA*   *Status*   *WIP*

Summative Assessment Strategies
4.1.   in a performance demonstration
4.2.   given an engineering drawing

Criteria
4.1.   Select and load tools according to the requirements of the job
4.2.   Select and set up work-holding devices for specific operations
4.3.   Verify machine set-up
4.4.   Verify proper application of speeds and feeds
4.5.   Operate machine tools according to established procedures
4.6.   Complete project within specified timeframe
4.7.   Take action to optimize machine tool operation

5.   MACH 5. Perform programming, set-up and operation of CNC Machine Tools
Type   *TSA*   *Status*   *WIP*

Summative Assessment Strategies
5.1.   in a performance demonstration

Criteria
5.1.   Write basic programs for specified CNC machine tools according to EIA-ISO standards
5.2.   Load the correct program into the machine
5.3.   Verify the accuracy of the CNC program
5.4.   Verify work and tool offsets
5.5.   Execute program
5.6.   Adjust speeds and feeds to optimize CNC machining conditions

Course Competencies

1.   Operate turning machines in a safe, efficient manner.
Domain   *Psychomotor*   *Level*   *Practicing*   *Status*   *Active*

Linked Core Abilities
Demonstrate ability to think critically.
Make decisions that incorporate the importance of sustainability.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

MACH 1. Apply basic safety practices in the machine shop
MACH 2. Interpret industrial/engineering drawings
MACH 3. Apply precision measuring methods to part inspection
MACH 4. Perform basic machine tool equipment set-up and operation

Assessment Strategies

1.1.   by demonstrating operation of machine controls to the instructor in the shop.
1.2.   by completing all related projects with a score of 75% or better using the machines in the shop.

Criteria

Your performance will be successful when:

1.1.   you complete and submit all related assignments.
1.2.   you demonstrate the location/operation of machine controls to the instructor.
1.3.   you complete the unit test with a score of 75% or better.
1.4.   you complete all related projects with and average score of 75% or better.

Learning Objectives

1.a.   Describe the function of all machine controls.
1.b.   Locate all machine controls.
1.c.   Recognize safety hazards associated with turning machines.
1.d.   Identify machine guards and their purpose.
1.e.   Employ machine guards and/or other safety devices as needed.

2.   Operate milling machine controls in a safe, efficient manner.

Domain   Cognitive   Level   Applying   Status   Active

Linked Core Abilities

Demonstrate ability to think critically.
Make decisions that incorporate the importance of sustainability.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

MACH 1. Apply basic safety practices in the machine shop
MACH 2. Interpret industrial/engineering drawings
MACH 3. Apply precision measuring methods to part inspection
MACH 4. Perform basic machine tool equipment set-up and operation

Assessment Strategies

2.1.   by locating and operating machine controls in demonstration to the instructor in the shop.
2.2.   by completing all related projects with a score of 75% or better using the machines in the shop.

Criteria

Your performance will be successful when:

2.1.   you complete and submit all related assignments.
2.2.   you locate/demonstrate machine controls to the instructor.
2.3.   you complete the unit test with a score of 75% or better.
2.4.   you complete all related projects with a score of 75% or better.

Learning Objectives

2.a.   learner will describe the function and location of machine controls.
2.b.   learner will demonstrate the ability to operate the machine controls.

3.   Run new programs in CNC vertical machining center or tool room mill.

Domain   Psychomotor   Status   Active

Linked Core Abilities

Apply mathematical concepts.
Demonstrate ability to think critically.
Demonstrate ability to value self and work ethically with others in a diverse population.

Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

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

Assessment Strategies

3.1.   In the machine tool lab or shop setting
3.2.   Using actual CNC machine tools
3.3.   In written and applied assignments
3.4.   Individually
3.5.   On tests and quizzes
3.6.   Given prints, stock, and all available shop equipment and supplies

Criteria

Performance will be satisfactory when:

3.1.   learner follows safety procedures 100% of the time when running CNC milling machines
3.2.   learner completes new program run check sheet prior to running new programs
3.3.   learner demonstrates the correct sequence to run programs in each type of CNC milling machine in the machine tool lab or shop
3.4.   learner correctly demonstrates the use of the single block function to run programs
3.5.   learner correctly demonstrates the procedures for changing speed and feed settings
3.6.   learner demonstrates the correct use of overrides to run programs for the first time
3.7.   learner references process sheets to verify the correct speed and feed settings
3.8.   learner demonstrates the process for turning the coolant on and off
3.9.   learner determines the correct direction and volume of the coolant flow
3.10.   learner runs a minimum of two different new parts in conversationally controlled CNC milling machines
3.11.   learner runs a minimum of two different new parts in automatic CNC machining centers
3.12.   learner demonstrates the correct procedures for changing tooling and resuming operation on manual CNC machines
3.13.   learner performs inspections before removing part from the machine
3.14.   learner completes all activities with a minimum of 70% accuracy
3.15.   learner scores a minimum of 70% on assignments, tests, and quizzes

Learning Objectives

3.a.   Observe safe operating procedures for running CNC milling machines
3.b.   Follow procedures to determine that all steps have been performed prior to running programs
3.c.   Locate and operate controls to run programs in CNC milling machines
3.d.   Use overrides to safely run programs for the first time
3.e.   Use single block function to safely run programs for the first time
3.f.   Verify speed and feed settings
3.g.   Change speed and feed settings
3.h.   Turn coolant on and off
3.i.   Change tools in manual CNC milling machines
3.j.   Resume program run after optional stops
3.k.   Run multiple new part programs in CNC milling machines

4.   **Run new programs in CNC turning centers or tool room lathes.**
Domain   Psychomotor   Status   Active

Linked Core Abilities

Apply mathematical concepts.
Demonstrate ability to think critically.
Demonstrate ability to value self and work ethically with others in a diverse population.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

MACH 1. Apply basic safety practices in the machine shop
MACH 3. Apply precision measuring methods to part inspection

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

Assessment Strategies
4.1.   In the classroom, lab, or shop setting
4.2.   Using actual CNC machine tools
4.3.   In written and applied assignments
4.4.   Individually
4.5.   On tests and quizzes
4.6.   Given prints, stock, and all available shop equipment and supplies

Criteria

Performance will be satisfactory when:

4.1.   learner follows safety procedures 100% of the time when running CNC turning machines
4.2.   learner completes new program run check sheet prior to running new programs
4.3.   learner demonstrates the correct sequence to run programs in each type of CNC turning machine in the machine tool lab or shop
4.4.   learner correctly demonstrates the use of the single block function to run programs
4.5.   learner correctly demonstrates the procedures for changing speed and feed settings
4.6.   learner demonstrates the correct use of overrides to run programs for the first time
4.7.   learner references process sheets to verify the correct speed and feed settings
4.8.   learner demonstrates the process for turning the coolant on and off
4.9.   learner determines the correct direction and volume of the coolant flow
4.10.   learner demonstrates the correct procedures for changing tooling and resuming operation on manual CNC machines
4.11.   learner runs a minimum of three different new parts in conversationally controlled CNC turning machines
4.12.   learner learner runs a minimum of two different new parts in automatic CNC turning centers
4.13.   learner runs a minimum of eight copies of one new part
4.14.   learner performs inspections before removing part from the machine
4.15.   learner completes all activities with a minimum of 70% accuracy
4.16.   learner scores a minimum of 70% on assignments, tests, and quizzes

Learning Objectives
4.a.   Observe safe operating procedures for running CNC turning machines
4.b.   Follow procedures to determine that all steps have been performed prior to running programs
4.c.   Locate and operate controls to run programs in CNC turning machines
4.d.   Use overrides to safely run programs for the first time
4.e.   Use single block function to safely run programs for the first time
4.f.   Verify speed and feed settings
4.g.   Change speed and feed settings
4.h.   Turn coolant on and off
4.i.   Change tools in manual CNC turning machines
4.j.   Resume program run after optional stops
4.k.   Run multiple new part programs in CNC turning center

5.   **Write multiple function programs for CNC vertical machining centers or tool room mills.**
       Domain   Cognitive   Status   Active

       Linked Core Abilities
       Apply mathematical concepts.
       Demonstrate ability to think critically.
       Demonstrate ability to value self and work ethically with others in a diverse population.
       Make decisions that incorporate the importance of sustainability.
       Transfer social and natural science theories into practical applications.
       Use effective communication skills.
       Use technology effectively.

       Linked Program Outcomes
       MACH 2. Interpret industrial/engineering drawings
       MACH 5. Perform programming, set-up and operation of CNC Machine Tools

       Assessment Strategies
       5.1.   In the classroom, lab, or shop setting

5.2. Using computers and actual CNC machine tools
5.3. In written and applied assignments
5.4. Individually
5.5. On tests and quizzes
5.6. Given prints, process sheets, specification sheets, and all available shop equipment and supplies

Criteria

Performance will be satisfactory when:

5.1. learner writes programs using manual cutter compensation
5.2. learner writes programs using G code cutter compensation
5.3. learner enters cutter compensation offsets in machine tool per program specifications
5.4. learner incorporates at least three tool changes in programs for CNC machining centers
5.5. learner incorporates at least three canned cycles in programs for CNC machining centers
5.6. learner writes a program that uses at least two subprogram calls
5.7. learner writes a program the incorporates cutter compensation, multiple tool changes, and subprograms
5.8. learner identifies and corrects program errors
5.9. learner proofs multiple function programs in simulator
5.10. multiple function programs are ran in CNC machining centers
5.11. multiple function programs are accurate enough to run in CNC machining centers
5.12. multiple function programs have accuracy of 90% or higher
5.13. assignments have accuracy of 90% or higher

Learning Objectives

5.a. Write CNC machining center programs using cutter compensation
5.b. Write CNC machining center programs with multiple tool changes
5.c. Write CNC machining center programs that use canned cycle programs
5.d. Write CNC machining center programs that incorporate subprograms

6. Write multiple function programs for CNC turning centers or tool room lathes.
Domain   Cognitive   Status   Active

Linked Core Abilities

Apply mathematical concepts.
Demonstrate ability to think critically.
Demonstrate ability to value self and work ethically with others in a diverse population.
Make decisions that incorporate the importance of sustainability.
Transfer social and natural science theories into practical applications.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

MACH 2. Interpret industrial/engineering drawings
MACH 5. Perform programming, set-up and operation of CNC Machine Tools

Assessment Strategies

6.1. In the classroom, lab, or shop setting
6.2. Using computers and actual CNC machine tools
6.3. In written and applied assignments
6.4. Individually
6.5. On tests and quizzes
6.6. Given prints, process sheets, specification sheets, and all available shop equipment and supplies

Criteria

Performance will be satisfactory 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 o 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

7.   Create a CNC program for a tool room mill or vertical machining center using CAM software.
Domain   *Cognitive*   *Level*   *Creating*   *Status*   *Active*

Linked Core Abilities
Apply mathematical concepts.
Demonstrate ability to think critically.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes
MACH 2. Interpret industrial/engineering drawings
MACH 5. Perform programming, set-up and operation of CNC Machine Tools

8.   Create a CNC program for a tool room lathe or turning center using CAM software.
Domain   *Cognitive*   *Level*   *Creating*   *Status*   *Active*

Linked Core Abilities
Apply mathematical concepts.
Demonstrate ability to think critically.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes
MACH 2. Interpret industrial/engineering drawings
MACH 5. Perform programming, set-up and operation of CNC Machine Tools