Western Technical College

31420335 CNC: Basic CAM 2

Course Outcome Summary

Course Information

Description	Intermediate programming using CAM software. Participants will create 2.5 dimension details in parts to be machined in CNC machining centers and turning centers. Order of operations, multiple level machining of milled parts, and advanced turning will be covered. Programs will be ran in the turning centers and machining centers.
Career Cluster	Manufacturing
Instructional Level	Technical Diploma Courses
Total Credits	1.00
Total Hours	36.00

Types of Instruction

Instruction Type	Credits/Hours
Lecture	1 CR / 36 HR

Course History

Pre/Corequisites

Prerequisite   31420325 CNC: Basic CAM 1

Textbooks

Mastercam Training Guide, Mill 2D. Publisher: Caminstructor Incorporated. **ISBN-13**: 978-1-927359-48-8. Required.

Mastercam Training Guide, Lathe. Publisher: Caminstructor Incorporated. **ISBN-13**: 978-1-927359-58-7. 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.

Core Abilities

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

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

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

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

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

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.   Create geometry using CAM software
Domain   Cognitive   *Level*   Application   *Status*   WIP

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

Linked Program Outcomes
MACH 2. Interpret industrial/engineering drawings

Assessment Strategies
1.1.   In the classroom, lab, or shop setting
1.2.   Using computer software
1.3.   In applied assignments
1.4.   Individually
1.5.   On tests and quizzes
1.6.   Given prints, files, tutorials, and course reference materials

Criteria

Performance will be satisfactory when:

1.1.   learner correctly selects the geometry tool required for specific applications
1.2.   learner completes the lines creation tutorial
1.3.   learner completes the circle creation tutorial
1.4.   learner completes the arc creation tutorial
1.5.   learner completes the fillet creation tutorial
1.6.   learner completes the dimensions creation tutorial
1.7.   learner accurately reproduces geometry from prints
1.8.   prints are drawn completely and accurately
1.9.   prints are completely and accurately dimensioned
1.10.   learner are drawn completely and accurately
1.11.   learner scores a minimum of 70% on rubric criteria for each assignment
1.12.   learner completes all activities by the due date
1.13.   learner scores a minimum of 70% on tests and quizzes

Learning Objectives
1.a.   Utilize geometry toolbar fly-out menus
1.b.   Create lines using CAM software
1.c.   Create circles using CAM software
1.d.   Create fillets using CAM software

1.e.	Create arcs using CAM software
1.f.	Create dimensions using CAM software
1.g.	Trim and extend geometry using CAM software
1.h.	Utilize the snap mode toolbar
1.i.	Reproduce prints using CAM geometry tools

2. Create 2.5D milling features using CAM software
Domain   *Cognitive*   *Level*   *Application*   *Status*   *WIP*

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

Linked Program Outcomes
MACH 2. Interpret industrial/engineering drawings

Assessment Strategies
2.1.	In the classroom, lab, or shop setting
2.2.	Using computer software
2.3.	In applied assignments
2.4.	Individually
2.5.	On tests and quizzes
2.6.	Given prints, tutorials, process sheets, specification sheets, and course reference materials

Criteria

Performance will be satisfactory when:
2.1.	learner selects the appropriate feature to machine specified part detail
2.2.	learner creates facing features per print specifications and directions
2.3.	learner creates hole features per print specifications and directions
2.4.	learner creates patterns for hole features
2.5.	learner creates pocket features per print specifications and directions
2.6.	learner creates boss features per print specifications and directions
2.7.	learner creates groove features per print specifications and directions
2.8.	learner creates side features per print specifications and directions
2.9.	learner creates multiple features per print specifications and directions
2.10.	learner edits feature properties to adhere to logical machining principles
2.11.	learner sets the appropriate Z offset for milling features
2.12.	learner sends all milling program files to instructor per directions
2.13.	features are created for machining efficiency
2.14.	learner scores a minimum of 70% on rubric criteria for each assignment
2.15.	learner completes all activities by the due date
2.16.	learner scores a minimum of 70% on tests and quizzes

Learning Objectives
2.a.	Describe the types of milling features that can be created in CAM programs
2.b.	Utilize the milling Features menu
2.c.	Create milling features from dimensions
2.d.	Create milling features from curves
2.e.	Create patterns from milling features
2.f.	Locate milling features in programs
2.g.	Set milling feature dimensions
2.h.	Select milling feature strategies

3. Create 2D turning features using CAM software
Domain   *Cognitive*   *Level*   *Application*   *Status*   *WIP*

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

Linked Program Outcomes
MACH 2. Interpret industrial/engineering drawings

Assessment Strategies
3.1.　　In the classroom, lab, or shop setting
3.2.　　Using computer software
3.3.　　In applied assignments
3.4.　　Individually
3.5.　　On tests and quizzes
3.6.　　Given prints, tutorials, process sheets, specification sheets, and course reference materials

Criteria

Performance will be satisfactory when:

3.1.　　learner selects the appropriate feature to machine specified part detail
3.2.　　learner creates hole features per print specifications and directions
3.3.　　learner creates outer diameter turning features per print specifications and directions
3.4.　　learner creates inner diameter turning features per print specifications and directions
3.5.　　learner creates boring features per print specifications and directions
3.6.　　learner creates groove features per print specifications and directions
3.7.　　learner creates facing features per print specifications and directions
3.8.　　learner creates cutoff features pre print specifications and directions
3.9.　　learner creates multiple features per print specifications and directions
3.10.　　learner edits feature properties to adhere to logical machining principles
3.11.　　learner sets the appropriate Z offset for turning features
3.12.　　features are created for machining efficiency
3.13.　　learner sends all turning program files to instructor per directions
3.14.　　learner scores a minimum of 70% on rubric criteria for each assignment
3.15.　　learner completes all activities by the due date
3.16.　　learner scores a minimum of 70% on tests and quizzes

Learning Objectives
3.a.　　Describe the types of turning features that can be created in CAM programs
3.b.　　Utilize the turning Features menu
3.c.　　Create turning features from dimensions
3.d.　　Create turning features from curves
3.e.　　Locate turning features in programs
3.f.　　Set turning feature dimensions
3.g.　　Select turning feature strategies

4.　　Select appropriate post processor and generate NC code
Domain　　Cognitive　　　　Level　　Application　　　　Status　　WIP

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 2. Interpret industrial/engineering drawings
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 computer software
4.3.　　In applied assignments
4.4.　　Individually
4.5.　　On tests and quizzes
4.6.　　Given prints, tutorials, files, and course reference materials

Criteria

Performance will be satisfactory when:
- 4.1. learner locates and opens post processor options
- 4.2. learner browses computer to find correct post processor
- 4.3. learner selects the correct post processor for a specific CNC machine tool
- 4.4. learner demonstrates the process to generate NC code
- 4.5. learner saves NC code with the correct name and in the correct locations
- 4.6. learner uses the correct application to open NC code text files
- 4.7. learner edits NC code text files as required for specific CNC machine tools
- 4.8. learner sends all NC code text files to instructor per directions
- 4.9. learner scores a minimum of 70% on rubric criteria for each assignment
- 4.10. learner completes all activities by the due date
- 4.11. learner scores a minimum of 70% on tests and quizzes

Learning Objectives
- 4.a. Locate post processor options
- 4.b. Select the required post processor
- 4.c. Generate NC code
- 4.d. Save NC code
- 4.e. Open and view NC code
- 4.f. Edit NC code text file

5. Prove-out CAM programs using 3D simulation and CNC machine graphical interface
Domain   Psychomotor   Level   Practice   Status   WIP

Linked Core Abilities
Apply mathematical concepts.
Use effective communication skills.

Linked Program Outcomes
MACH 1. Apply basic safety practices in the machine shop
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 computer software and actual CNC machine tools
- 5.3. In applied assignments
- 5.4. Individually and in groups
- 5.5. On tests and quizzes
- 5.6. Given diagrams, materials, and all available shop equipment and supplies

Criteria

Performance will be satisfactory when:
- 5.1. learner identifies a minimum of three locations to open the simulation toolbar
- 5.2. learner correctly describes the centerline, 2D, and 3D simulation tools
- 5.3. learner demonstrates playing and stopping simulation
- 5.4. learner proofs programs using center line simulation
- 5.5. learner proofs programs using 2D simulation
- 5.6. learner proofs programs using 3D simulation
- 5.7. learner views simulation in multiple views
- 5.8. learner demonstrates the use of single step simulation
- 5.9. learner correctly identifies errors in programs using simulation tools
- 5.10. learner proofs programs in CNC turning center graphical simulators
- 5.11. learner proofs programs in CNC machining center graphical simulators
- 5.12. learner correctly identifies errors in programs ran in CNC machine tool graphical simulators
- 5.13. learner accurately documents program errors discovered in CNC machine tool graphical simulators
- 5.14. learner edits programs to correct errors
- 5.15. programs are corrected to run safely in CNC machine tools
- 5.16. learner scores a minimum of 70% on rubric criteria for each assignment
- 5.17. learner completes all activities by the due date

5.18.   learner scores a minimum of 70% on tests and quizzes

Learning Objectives
5.a.   Describe the types of CAM simulation tools
5.b.   Utilize the CAM simulation menu
5.c.   Demonstrate the use of CAM simulation tools
5.d.   Determine the accuracy of CAM programs using simulation tools
5.e.   Utilize the CNC machine tool graphical simulation function
5.f.   Demonstrate the use of CNC machine tool graphical simulators
5.g.   Determine the accuracy of CAM programs using CNC machine tool graphical simulators
5.h.   Edit programs as required to run in CNC machine tool graphical simulators