Course Number          Course Title                                             Credits
MET232  Advanced Computer Numerically Controlled (CNC) Machines     3

Hours: Lecture.lab Pre-requisite Implementation
2/3 MET231 F/2017

COURSE DESCRIPTION

Investigates advanced theory and practical CAD/CAM (Computer Aided Drafting / Computer Aided Manufacturing) software concepts on computer numerical controlled (CNC) machining equipment used in industry to manufacture extremely precise and complicated machine tool products. Topics include CAD/CAM software (Mastercam) to produce complex machined parts, G and M code post-processing operations and machine tool safety practices. Corresponding labs reinforce lectures with practical hands-on examples which follow NIMS certification requirements.

Required Textbook:

Introduction to Computer Numerical Control (CNC)
By James V. Valentino and Joseph Goldenberg
Publisher: Pearson Education

Optional:
Precision Machining Technology
By Peter J. Hoffman and Eric S. Hopewell
Publisher: Delmar/Cengage Learning

Revision Date: 4/5/2017 Course Coordinator: D.T.DeFino 3456 definod@mccc.edu
General Education Knowledge Goals [GEKG]

Goal 1. Communication. Students will communicate effectively in both speech and writing.
Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.
Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

MCCC Core Skills [CS]

Goal A. Written and Oral Communication in English. Students will communicate effectively in speech and writing, and demonstrate proficiency in reading.
Goal B. Critical Thinking and Problem-solving. Students will use critical thinking and problem solving skills in analyzing information.
Goal D. Information Literacy. Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.
Goal E. Computer Literacy. Students will use computers to access, analyze or present information, solve problems, and communicate with others.
Goal F. Collaboration and Cooperation. Students will develop the interpersonal skills required for effective performance in group situations.

General Objectives [GO]

Course Competencies/Goals

Students will be able to:

1/ Properly demonstrate safe operation of CNC milling and lathe equipment. (GEKG 1, 4 / CS A, B, F)
2/ Become familiar with industry reference materials used for CNC machining calculations. (GEKG 2, 4 / CS A, B, D)
3/ Demonstrate proper work holding setups based on various CNC milling and lathe operations. (GEKG 1, 2, 4 / CS A, B, D)
4/ Perform basic CNC automated machining operations using G and M coding. (GEKG 1, 2, 4 / CS A, B, E)
5/ Manufacture CNC parts using CAD/CAM software to create complicated M and G codes. (GEKG 1, 2, 4 / CS A, B, E)
6/ Learn and follow proper shop safety practices and policies. (GEKG 1 / CS A, B, D, F)
Unit Objectives

Unit I - Introduction to Advanced Computer Numerical Control (CNC) Mill Topics

The student will be able to:

1. Identify all major CNC vertical mill components. (GO 1)
2. Understand proper safety guidelines when using CNC vertical milling equipment. (GO 1, 6)
3. Identify and understand the operational control components of a CNC vertical mill. (GO 1)
4. Determine machine tool requirements using industry reference materials. (GO 2)
5. Understand M and G programing codes used to automate CNC milling processes. (GO 4)
6. Perform speed and feed rate adjustments using CNC vertical mill controls. (GO 1, 2)
7. Become familiar with various work holding methods used on CNC vertical mills. (GO 1, 3)
8. Create CAD/CAM software programs to manufacture complicated CNC milling parts. (GO 2, 5)

Unit II - Introduction to Advanced Computer Numerical Control (CNC) Lathe Topics

The student will be able to:

1. Identify all major CNC lathe components. (GO 1)
2. Understanding proper safety guidelines when using CNC lathe equipment. (GO 1, 6)
3. Identify and understand the operational control components of the CNC lathe. (GO 1)
4. Determine machine tool requirements using industry reference materials. (GO 2)
5. Understand M and G programing codes used to automate CNC lathe processes. (GO 4)
6. Perform speed and feed rate adjustments using CNC lathe controls. (GO 1, 2)
7. Become familiar with various work holding methods used on CNC lathes. (GO 1, 3)
8. Create CAD/CAM software programs to manufacture complicated CNC lathe parts. (GO 2, 5)

Unit III Advanced CNC Mill and Lathe Machining Operations

The student will be able to:

1. Using CAD/CAM software to develop complicated project code for CNC vertical mill. (GO 5)
2. Using CAD/CAM software to develop complicated project code for a CNC lathe. (GO 5)
3. Demonstrate proper procedure to correctly download NC code for CNC machine. (GO 4, 5)
4. Verify proper operation of CNC program created using CAD/CAM NC code. (GO 4)
5. Demonstrate proper work holding setup required for CNC operations. (GO 3)
6. Calculate proper speed and feed rate for specific CNC operations. (GO 2)
7. Calculate proper work offset setup to accurately configure CNC equipment alignment. (GO 3)
8. Verify CNC machine tools are correctly installed into CNC equipment. (GO 1)
**Method of Instruction**

Learning will take place via classroom instruction, lab demonstrations, and student activities, as well as through textbook reading and homework assignments. Lab activities will augment this. Use of equipment and manual skills will be developed in the lab.

**Student Evaluation**

Students’ achievement of the course objectives will be evaluated through the use of the following:

- Three unit tests assessing students’ comprehension of terminology, calculations and practices related to the unit objectives. (GO 1, 2, 5)
- Lab grade based on shop projects and lab assignment results. (GO 1, 3, 4)
- In class participation, homework assignments and attendance. (GO 1, 2 and 3)

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<thead>
<tr>
<th>Evaluation Tools</th>
<th>%</th>
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<tbody>
<tr>
<td>3 Unit Tests</td>
<td>60%</td>
</tr>
<tr>
<td>Lab Assignments / Shop Projects</td>
<td>20%</td>
</tr>
<tr>
<td>Homework / In-Class Assignments</td>
<td>20%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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**Academic Integrity**

Students are required to perform all the work specified by the faculty and are responsible for the content and integrity of all academic work submitted, such as papers, reports, and examinations. A student will be guilty of violating the Rule of Academic Integrity if he or she:

- Knowingly represents the work of others as his or her own;
- Uses or obtains unauthorized assistance in any academic work;
- Gives fraudulent assistance to another student.
- Intentionally damages any contents of the lab or classroom
- Is found to have stolen anything from the lab or classroom

**Penalty**
First violation for stealing or damaging is F in the course.
First violation on test or project is an “F” grade for the test or project.
Second violation is “F” in the course.

**Special Accommodations**

Any student in this class who has special needs because of a disability is entitled to receive accommodations. Eligible students at Mercer County Community college are assured services under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973. If you believe you are eligible for services, please contact Arlene Stinson, the Director of Academic Support Services at her office in LB 221 or at the office telephone number which is (609) 570-3525.

Mercer County Community College is in compliance with both the ADA and section 504 of the Rehabilitation Act. If you have, or believe you have, a differing ability that is protected under the law please see Arlene Stinson in LB216 (570-3525 stinsona@mccc.edu) for information regarding support services.