COURSE OUTLINE

Course Number AMT 231	**Course Title** Introduction to Computer Numerically Controlled Machines	**Credits** 3.0

Hours: **Lecture/Lab/Other** 2/3	**Co- or Pre-requisite** AMT110/AMT 102	**Implementation** **Semester & Year** Fall 2022

Catalog description:
Introduces the theory and practical concepts of computer numerical controlled (CNC) machining equipment used in industry to manufacture extremely precise machine tool products.   Topics include CNC equipment and terminology, G and M code familiarization and machine tool safety practices. Corresponding labs reinforce lectures with practical hands-on examples which follow NIMS certification requirements.

General Education Category: **Not GenEd**	**Course coordinator:** Michael Hanna, 609-570-3828, hannam@mccc.edu

Required texts & Other materials:
Programming of CNC Machines, 4th Edition.
Kay Evans.
Industrial press. ISBN: 9780831135249

Course Student Learning Outcomes (SLO):
   Upon successful completion of this course the student will be able to:
   1. Properly demonstrate safe operation of CNC milling and lathe equipment. **(ILG, 10, 11, PLO,1, 6,10)**
   2. Become familiar with industry reference materials used for CNC machining calculations **(ILG, 4,10, 11, PLO,6,10)**
   3. Demonstrate proper work holding setups based on various CNC milling and lathe operations **(ILG, 4,10, 11, PLO,6,10)**
   4. Perform basic CNC automated machining operations using G and M coding. **(ILG, 4,10, 11, PLO,6,7,10)**

Course-specific Institutional Learning Goals (ILG):
Institutional Learning Goal 2 Mathematics: Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Institutional Learning Goal 3 Science: Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.
Institutional Learning Goal 4 Technology: Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.
Institutional Learning Goal 10 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.
Institutional Learning Goal 11 Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Program Learning Outcomes for (PLO)
1. Maintain a safe and organized workspace.
2. Interpret blueprints to manufacture parts.
3. Apply shop and tool room mathematics as needed.
4. Complete part inspection using appropriate instruments such as micrometers, calipers, and scales.
5. Set up and operate a manual drill press, lathe, milling machine, grinder and press brake.
6. Set up and operate CNC machines (lathe and mill).
7. Use NC programming (G and M codes) to control movement and cutting processes.
8. Understanding of statistical quality control.
9. Understanding of the broad spectrum of manufacturing technologies.
10. Pursue NIMS certification.

Units of study in detail – Unit Student Learning Outcomes:
Unit I Introduction to Computer Numerical Control (CNC) Mill Components (**SLO 1,3**)
The student will be able to:
1. Identify all major CNC vertical mill components.
2. Understand proper safety guidelines when using CNC vertical milling equipment.
3. Identify and understand the operational control components of a CNC vertical mill.
4. Determine machine tool requirements using industry reference materials.
5. Understand M and G programing codes used to automate CNC milling processes
6. Perform speed and feed rate adjustments using CNC vertical mill controls.
7. Become familiar with various work holding methods used on CNC vertical mills.
8. Properly use CNC digital readout (DRO) to determine desired Cartesian coordinates.

 Unit II Introduction to Computer Numerical Control (CNC) Lathe Components (**SLO 1,3**)
The student will be able to:
1. Identify all major CNC lathe components.
2. Understand proper safety guidelines when using CNC lathe equipment.
3. Identify and understand the operational control components of the CNC lathe.
4. Determine machine tool requirements using industry reference materials.
5. Understand M and G programing codes used to automate CNC lathe processes.
6. Perform speed and feed rate adjustments using CNC lathe controls.
7. Become familiar with various work holding methods used on CNC lathes.
8. Properly use CNC digital readout (DRO) to determine desired Cartesian coordinates.

<u>Unit III Advanced CNC Mill and Lathe Machining Operations</u> (**SLO 2,4)**
The student will be able to:
 Demonstrate proper procedure to correctly setup a CNC vertical mill.
1. Demonstrate proper procedure to correctly setup a CNC lathe
2. Perform loading of CNC milling program created using M and G coding.
3. Perform loading of CNC lathe program created using M and G coding.
4. Demonstrate proper work holding setup required for CNC operations.
5. Calculate proper speed and feed rate for specific CNC operations.
6. Calculate proper work offset setup to accurately configure CNC equipment alignment.
7. Verify CNC machine tools are correctly installed into CNC equipment.

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.

Evaluation of student learning:

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.
- Lab grade based on shop projects and lab assignment results.
- In class participation, homework assignments and attendance.

Evaluation Tools	
3 Unit Tests	60%
Lab Assignments / Shop Projects	20%
Homework / In-Class Assignments	20%
Total	100%