Course Acronym:	ETEC
Course Number:	16
Descriptive Title:	Computer Integrated Manufacturing
Division:	Industry and Technology
Department:	Engineering Technology
Course Disciplines:	Engineering Technology, Manufacturing Technology
Catalog Description:	This course covers the integration of engineering technology principles and automation in manufacturing environments. Students will create three-dimensional designs with modeling software and produce actual components of their designs on Computer Numerically Controlled (CNC) machine tools. Additional topics covered include machine tool operations, simulations, Rapid Prototyping (RP), robotics, and manufacturing systems.
Prerequisite:	
Co-requisite:	
Recommended Preparation:	
Enrollment Limitation:	
Hours Lecture (per week):	2
Hours Laboratory (per week):	4
Outside Study Hours:	4
Total Course Hours:	108
Course Units:	3
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	1/23/2006
Transfer UC:	No
Effective Date:	
General Education: ECC	
Term:	
Other:	
CSU GE:	
Term:	

Other:	
IGETC:	
Term:	
Other:	
Student Learning Outcomes:	**SLO #1 Solid Modeling** Students will measure and solid model a provided assembly. **SLO #2 Robotic Arm: Palletize** Students will program a robot arm to palletize parts. **SLO #3 CNC Mill: Initials** Students will program a CNC mill to engrave their initials in a block of wood.
Course Objectives:	1. Answer objective questions about machine tool safety with 100% accuracy. 2. Select appropriate cutting tools to efficiently, safely, and accurately machine parts on CNC machines. 3. Create three-dimensional models of simple machined parts. 4. Convert geometry from Computer Aided Design (CAD) databases to CNC part geometry. 5. Create tool motion routines such as drilling, milling and turning with industry standard Computer Aided Manufacturing (CAM) software. 6. Calculate speeds and feeds for common machine tool operations. 7. Setup and operate CNC milling machines to perform simple operations such as milling and drilling. 8. Compare and contrast the common types of robotic controls. 9. Evaluate the applied benefit in using robotics and other automated processes in a manufacturing environment. 10. Discuss the individual components of a flexible manufacturing system. 11. Create true scale models utilizing rapid prototyping techniques.
Major Topics:	**I. SAFETY (2 hours, lecture)** A. Careers in automation, manufacturing and engineering technology B. Lab safety **II. SAFETY (4 hours, lab)** A. Careers exercise B. Lab safety exercise **III. PARTS MODELING (4 hours, lecture)** A. Creating work features B. Creating solids C. Working drawings D. Editing techniques E. Model assembly F. Rapid-prototyping

G. Reverse engineering

IV. PARTS MODELING (8 hours, lab)

A. Solid modeling exercise
B. Reverse engineering exercise

V. CNC MACHINING (14 hours, lecture)

A. Machine components, axis identification
B. Measurement, speeds and feeds
C. Work holding, tools and fixtures
D. Setup and operation

VI. CNC MACHINING (28 hours, lab)

A. Machine setup exercise
B. CNC machining exercise

VII. CNC PROGRAMMING (8 hours, lecture)

A. CAM systems
B. CAD/CAM conversion
C. Tool motion
D. Simulations
E. CNC codes
F. Transmitting files

VIII. CNC PROGRAMMING (16 hours, lab)

A. CAM system exercise
B. Tool motion exercise

IX. ROBOTICS (6 hours, lecture)

A. Robotics and automated systems
B. Controllers
C. End effectors
D. Robot applications

X. ROBOTICS (12 hours, lab)

A. Robot programming exercise
B. Robot application exercise

XI. MANUFACTURING SYSTEMS (2 hours, lecture)

A. Types of Computer Integrated Manufacturing (CIM) systems
B. Components of CIM systems
C. CIM System applications

	XII. MANUFACTURING SYSTEMS (4 hours, lab) A. CIM identification exercise B. CIM system exercise
Total Lecture Hours:	36
Total Laboratory Hours:	72
Total Hours:	108
Primary Method of Evaluation:	3) Skills demonstration
Typical Assignment Using Primary Method of Evaluation:	Design a 4" x 6" picture frame that incorporates 3/4" thick plastic stock. The frame must exhibit a rabbet in the back, and a milled pocket to enable hanging. Submit frame to the instructor for evaluation.
Critical Thinking Assignment 1:	Create a 3D model of a prototype sample for the wheel spindle using reverse engineering techniques. Save the model and convert the geometry to CNC tool motion using CAM software. Submit 3D model to the instructor on your removable media.
Critical Thinking Assignment 2:	Reverse engineer an assigned child's toy that has a minimum of two linkage moving parts. Re-engineer the moving parts so that they can be produced by CNC milling processes. Create a solid model of your new design. Save solid model to your removable media and submit to the instructor for evaluation.
Other Evaluation Methods:	Performance Exams Other Exams Quizzes Written Homework Laboratory Reports Class Performance Term or Other Papers Multiple Choice Completion Matching Items True/False
Instructional Methods:	Demonstration Lecture Multimedia presentations
If other:	Computer simulations
Work Outside of Class:	Problem solving activity Required reading Study
If Other:	
Up-To-Date Representative Textbooks:	Michael Hacker. Engineering and Technology. 1ST Edition. Cengage Learning, 2010. (Discipline Standard)
Alternative Textbooks:	
Required Supplementary Readings:	Project Lead the Way handouts https://www.pltw.org/

Other Required Materials:	Flash drive - removable media
Requisite:	
Category:	
Requisite course(s): List both prerequisites and corequisites in this box.	
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	
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Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	
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Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	Steve Cocca/Eric Carlson
Date:	10/27/2015
Original Board Approval Date:	01/23/2006
Last Reviewed and/or Revised by:	Eric Carlson
Date:	03/13/2023
Last Board Approval Date:	07/17/2023 effective FALL 2024