Course Acronym:	ETEC
Course Number:	16B
Descriptive Title:	Computer Integrated Manufacturing II
Division:	Industry and Technology
Department:	Engineering Technology
Course Disciplines:	Engineering Technology, Manufacturing Technology
Catalog Description:	This is the second of two courses that cover 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 simulations, Rapid Prototyping (RP), and manufacturing systems. *Note: The two-course sequence Engineering Technology 16A and Engineering Technology 16B is the same as Engineering Technology 16.*
Prerequisite:	
Co-requisite:	
Recommended Preparation:	Engineering Technology 16A
Enrollment Limitation:	
Hours Lecture (per week):	1
Hours Laboratory (per week):	2
Outside Study Hours:	2
Total Course Hours:	54
Course Units:	1.5
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	12/15/2008
Transfer UC:	No
Effective Date:	
General Education: ECC	
Term:	
Other:	

CSU GE:	
Term:	
Other:	
IGETC:	
Term:	
Other:	
Student Learning Outcomes:	**SLO #1 Robotic Arm: Palletize** Students will program a robot arm to palletize parts. **SLO #2 Robotic Arm: Tool Frame** Students will program a tool frame (tool coordinates) for a robot arm. **SLO #3 Robotic Arm: User Frame** Students will program a user frame (workpiece coordinates) for a robot arm.
Course Objectives:	1. Answer objective questions about machine tool safety with 100% accuracy. 2. Develop three-dimensional models of simple machined parts. 3. Convert geometry from Computer Aided Design (CAD) databases to CNC part geometry. 4. Create tool motion routines such as drilling, milling and turning with industry standard Computer Aided Manufacturing (CAM) software. 5. Produce true scale models utilizing rapid prototyping techniques. 6. Evaluate the applied benefit in using robotics and other automated processes in a manufacturing environment. 7. Discuss the individual components of a flexible manufacturing system.
Major Topics:	**I. Orientation and Safety (2 hours, lecture)** A. Careers in automation,manufacturing, and engineering technology B. Safety **II. Orientation and Safety (4 hours, lab)** A. Careers exercise B. 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. Creating solids exercise B. Reverse engineering exercise **V. CNC Machining (4 hours, lecture)** A. Work holding, tools and fixtures B. Setup and operation **VI. CNC Machining (8 hours, lab)** A. Machine setup exercise B. CNC machining exercise **VII. CNC Programming (6 hours, lecture)** A. CAM systems B. CAD/CAM conversion C. Tool motion D. Simulations E. CNC codes F. Transmitting files **VIII. CNC Programming (12 hours, lab)** A. CAM system exercise B. Tool motion exercise **IX. Manufacturing Systems (2 hours, lecture)** A. Types of Computer Integrated Manufacturing (CIM) systems B. Components of CIM systems C. CIM System applications **X. Manufacturing Systems (4 hours, lab)** A. System indentification exercise B. CIM system exercise
Total Lecture Hours:	18
Total Laboratory Hours:	35
Total Hours:	54
Primary Method of Evaluation:	2) Problem solving demonstrations (computational or non-computational)
Typical Assignment Using Primary Method of Evaluation:	Design a 4" x 6" picture frame that incorporates ¾" thick plastic stock. The frame must exhibit a rabbet in the back and a milled pocket to enable hanging. Submit to the instructor for evaluation.
Critical Thinking Assignment 1:	Create a 3D model of the 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 a screen plot of the tool motion to the instructor for evaluation.
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 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
Instructional Methods:	Demonstration Laboratory Lecture Multimedia presentations
If other:	Computer simulations
Work Outside of Class:	Study Required reading Problem solving activities
If Other:	
Up-To-Date Representative Textbooks:	Michael Hacker. Engineering & Technology. 1st ed. Delmar Cengage Learning, 2009. (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).	

Requisite Skill:	
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	
Requisite course:	Engineering Technology-16A
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	**Work with machine and hand tools safely.** ETEC 16A - Answer objective questions about machine tool safety with 100% accuracy. ETEC 16A - Answer objective questions about machine tool safety with 100% accuracy. ETEC 16A - Select appropriate cutting tools to efficiently, safely, and accurately machine parts on Computer Numerical Control (CNC) machines. ETEC 16A - Setup and operate CNC milling machines to perform simple operations such as milling and drilling. **Identify different basic cutting tools and describe their function.** ETEC 16A - Select appropriate cutting tools to efficiently, safely, and accurately machine parts on Computer Numerical Control (CNC) machines.
Requisite Skill:	
Requisite Skill and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s). If applicable	
Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	Eric Carlson
Date:	09/01/2008
Original Board Approval Date:	12/15/2008
Last Reviewed and/or Revised by:	Eric Carlson
Date:	03/13/2023
Last Board Approval Date:	07/17/2023 effective FALL 2024