



Career Education at Folsom Lake College



FOLSOM LAKE COLLEGE
EL DORADO CENTER | RANCHO CORDOVA CENTER

MANUFACTURING & INDUSTRIAL TECHNOLOGY (MITECH)

The Manufacturing and Industrial Technology (MITECH) program provides engineering principles and technical skills for the manufacture of products and related industrial processes. Processes include shaping and forming operations, materials handling, instrumentation, controls, quality control, Computer Aided Manufacturing (CAM), and robotics. Optimization theory, industrial and manufacturing planning, and related management skills are also included in the discipline.

Benefits of enrolling in our MITECH program:

- Aligned with the Society of Manufacturing Engineers (SME) Certified Manufacturing Technologist (CMfgT) list of core competencies
- Supports the foundational skills for those planning to transfer to a four-year degree pathway related to manufacturing/ industrial process
- Supports SME Certified Manufacturing Engineering (CMfgE) goals through further study



Degree

A.S. Manufacturing and Industrial Technology



Certificates

- CAD/CAM Programming
- Manufacturing and Industrial Technology
- Production Planning
- Quality Technician

Questions? Contact us!

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Course Outline
Folsom Lake College
Los Rios Community College District

Section 1: Curriculum Cycle Information

Course: MITECH 320: Introduction to CAD/CAM Programming
Outline Status: Catalog
Last Full Review: Apr 23, 2021
Last Curriculum Action: May 30, 2021
Catalog Date: Jun 01, 2021
Official: Yes

Section 2: Basic Course Information

Identifier: MITECH 320
Title: Introduction to CAD/CAM Programming
Units: 3.00
Prerequisite: None.
Hours: 36 hours lecture, 54 hours laboratory, 72 hours out-of-class work, for a total of 162 student learning hours.
Description: This course is an introductory course to Computer Aided Design and Computer Aided Manufacturing (CAD/CAM) advanced manufacturing software. The course covers the fundamentals of developing CAD models of parts, fixture assemblies, and applying CAM strategies and techniques to program code for 2-3 Axis Computer Numerical Controlled (CNC) manufacturing equipment. This course introduces the process that takes a product from CAD concept to generating CAM toolpath and compiling the toolpath into CNC code that can be applied to drive simple CNC controlled processes. Processes supported by this class include laser cutting, plasma cutting, water jet cutting, routing, milling, and turning. This course is intended for individuals pursuing career pathways related to advanced manufacturing and product development.

Section 3: Learning Outcomes and Objectives

Upon completion of this course, the student will be able to:

- Analyze given design data defining parts, and apply design thinking and principles to plan and evaluate strategies for work-holding, machining processes, and cutting tools required to manufacture the product.
 - Analyze given design data defining parts, and apply design thinking and principles to plan the CAD/CAM programming strategies required to manufacture the product on CNC machine tools.
 - Apply programming commands from each of the two-axis machine processes for cutting, milling, and lathe operations and simulate the toolpath.
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Section 4: Course Topics

The topics for this course are typically allocated as follows:

Lec Lab Topic

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| 4 | 0 | Introduction to CAD/CAM technology: An overview of the role of CAD/CAM technology in the product design and realization cycle and definition of significant manufacturing processes related to CAD/CAM and CNC technology will be presented. Instructor will review the related documentation requirements associated with generating operator set-up instructions to accompany CNC programs. |
| 0 | 1 | Introduction to CAD/CAM technology: Students will demonstrate their understanding of operator set-up instructions generated by the CAD/CAM software through lab activities. |
| 2 | 0 | Navigating CAD/CAM Software and Workspaces: A brief introduction to the CAD/CAM software graphical interface and the different workspaces, including model space, sketch mode, the relationship with the cartesian planes, and an overview |

demonstration of basic geometry creation and constraint commands will be presented.

- 0 1 Navigating CAD/CAM Software and Workspaces: Students will demonstrate their understanding of CAD/CAM software and workspaces through lab activities.
- 2 0 Basic Design Tools: Basic CAD software design tools, including the basics of the design workspace along with commonly used create, modify, and constraint commands will be presented.
- 0 2 Basic Design Tools: Students will demonstrate their understanding of basic CAD software design tools through authentic, real-world lab exercises.
- 4 0 Developing Models: Development of CAD models by reading drawings and measuring physical parts, including the basics of using metrology tools, reading drawings, and an introduction to basic Solid Create and Modify commands will be presented.
- 0 10 Developing Models: Students will demonstrate their understanding of the development of CAD models through authentic, real-world lab exercises.
- 2 0 Developing Sheet Metal Flat Patterns: Definition of basic sheet metal parts using CAD design tools including Flange, Unfold, and Flat Pattern, and defining parameters for sheet metal bending will be presented.
- 0 2 Developing Sheet Metal Flat Patterns: Students will demonstrate their understanding of developing sheet metal flat patterns through authentic, real-world lab exercises.
- 4 0 Creating Fixture Assemblies: Creation of assemblies of CAD models using the assembly joint commands, and file management techniques, including the pros and cons of both top-down and bottom-up assembly design strategies will be presented.
- 0 6 Creating Fixture Assemblies: Students will demonstrate their understanding of the creation of assemblies of CAD models through authentic, real-world lab exercises.
- 2 0 Introduction to CAM and 2 Axis Cutting: Introduction to CAM, including the basics of the Manufacturing Workspace, creating Set-ups, and basic centerline toolpath for XY cutting tables such as CNC waterjets, CNC lasers, and CNC plasma cutting machines will be presented.
- 0 4 Introduction to CAM and 2 Axis Cutting: Students will demonstrate their understanding of CAM and 2 axis cutting through authentic, real-world lab exercises.
- 2 0 Cutting Tools and Creating Tool Libraries: Creating tools and tool library files for different types of CNC rotary and stationary cutting tools, and an overview of different milling, drilling, and turning tools used in CNC mills, CNC routers, and CNC lathes will be presented.
- 0 2 Cutting Tools and Creating Tool Libraries: Students will demonstrate their understanding of creating tools and tool library files for different types of CNC rotary and stationary cutting tools through authentic, real-world lab exercises.
- 4 0 2 Axis CAM - Lathe: Introduction to CAM for CNC lathes, including the basics of lathe set-ups in the manufacturing workspace, and basic 2-axis lathe CAM commands and drilling cycles for simple CNC lathes will be presented.
- 0 10 2 Axis CAM - Lathe: Students will demonstrate their understanding of CAM for CNC lathes through authentic, real-world lab exercises.
- 4 0 Basic 3 Axis CAM - Milling: An introduction to CAM for CNC Mills and CNC routers, including the basics of mill set-ups in the manufacturing workspace will be presented. Basics 2-1/2 axis mill CAM commands, including 2D adaptive clearing, face milling, profiling, pocketing, and drilling cycles for simple CNC mills and CNC routers, and milling of and drilling of turned parts will also be presented.
- 0 14 Basic 3 Axis CAM -Milling: Students will demonstrate their understanding of CAM for CNC Mills and CNC routers through authentic, real-world lab exercises.
- 6 0 This time is allotted for assessment.
- 0 2 This time is allotted for assessment.

36 54 Total Hours

Section 5: Methods of Instruction

Methods of instruction may include lectures, computer simulations, hands-on activities, discussions, demonstrations, group activities, guest lectures, local facility tours, video and multimedia presentations.

Section 6: Typical Student Assignments

Example 1: Given technical specifications for a part, analyze the information, and develop a process plan and sequence to machine the part in the form of a written process set-up sheet including cutting tool list and raw material stock size.

Example 2: Given technical specifications for a part that is made using a machining process, model the part, apply CAD/CAM toolpath, and compile CNC code to machine the part using 2-3 axis of machine motion.

Section 7: Evaluation and Assessment Methods

Students will be evaluated by objective exams, planning exercises, and demonstration of problem-solving skills applied to projects.

Section 8: Distance Education

Percentage: Up to 100% of this course may be offered via distance education.

The same standards of course quality shall be applied to any portion of this course conducted through distance education as are applied to in-person classes. All components of this course outline, including student learning outcomes, course topics, methods of instruction and evaluation, and student assignments, have been reviewed to ensure that learning outcomes for this course can be met when it is delivered through distance education to the extent indicated above by the percentage and additional limitations if applicable.

The distance education portion of this course shall include regular effective contact between instructor and students, and among students, either synchronously or asynchronously. The activities conducted to meet this requirement will be determined by the instructor teaching the class and will be clearly communicated to students. These interactions can take place through various activities that may include, but are not limited to: email, instant messaging, discussion boards, group assignments, video conferencing, and audio conferencing.

The distance education portion of this course shall maintain compliance with the Requirements of the Americans with Disabilities Act (42 U.S.C. § 12100 et seq.) and section 508 of the Rehabilitation Act of 1973, as amended, (29 U.S.C. § 749d). Examples of how the accessibility of course materials will be ensured may include (but are not limited to): the use of accessible documents (.doc, .pdf, etc.), alt-text for images, captioned videos, text transcripts for audio files, etc.

Section 9: Emergency Closure Distance Education

During a college/facility emergency closure, this course may be offered via distance education. When taught online during a college/facility emergency closure, the course shall include regular and effective contact as required by Title 5 and adhere to the Americans with Disabilities Act (ADA) and section 508 of the Rehabilitation Act. Course outcomes will be met by providing synchronous or asynchronous instruction using the learning management system. Assessments, assignments, and projects may be collected and evaluated via the learning management system.

In order to offer this course via distance education outside of a college/facilities emergency closure, regular distance education curriculum approval must be granted separately from this college/facility emergency closure addendum.

Approved:

Section 10: Representative List of Textbooks

- Davis, C. (2011). *Fundamentals of CNC Machining: Using Integrated CAM Software*. Inspirtech LLC. [ISBN: 978-0615500591]
 - Fitzpatrick, M. (2018). *Machining and CNC Technology*. (4th ed.). New York: Mcgraw-Hill Education. [ISBN: 978-1260092608]
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Section 11: Additional Course Information

Faculty Discipline(s):	Electromechanical Technology, Industrial Technology, Instructional Design/Technology, Machine Tool Technology, Manufacturing Technology, Sheet Metal, or Welding
Short Title for Transcripts:	Introduction to CAD/CAM
Type of Grading:	Letter Grade
Times Taken for Credit:	This course may be taken 1 time for credit.
Enrollment Family:	Not Part of a Family
Cross-listed Courses:	None.

Taxonomy of Programs (TOP) Code: 0956.00* (*Manufacturing and Industrial Technology*)

Student Accountability Model (SAM) Code: D (*Possibly Occupational*)

Section 12: Relationship to College Programs

Need/Purpose for the Course: This course is an introductory course to Computer Aided Design and Computer Aided Manufacturing (CAD/CAM) advanced manufacturing software. The course covers the fundamentals of developing CAD models of parts, fixture assemblies, and applying CAM strategies and techniques to program code for 2-3 Axis Computer Numerical Controlled (CNC) manufacturing equipment. This course introduces the process that takes a product from CAD concept to generating CAM toolpath and compiling the toolpath into CNC code that can be applied to drive simple CNC controlled processes. Processes supported by this class include laser cutting, plasma cutting, water jet cutting, routing, milling, and turning. This course is intended for individuals pursuing career pathways related to advanced manufacturing and product development.

Degrees and Certificates: CAD/CAM Programming (Certificate); Manufacturing and Industrial Technology (A.S. Degree)

Prerequisite To: MITECH 321

Corequisite To: None.

Advisory To: MITECH 313

Embedded In Descriptions:

Section 13: Relationship to Transfer Institutions

Transfer: CSU *Approved: Aug 01, 2021* (Added to ASSIST as CSU transferable course.)

Section 14: Digital Signatures

Faculty Initiator: Zachary Dowell

Department/Subject: MITECH

Department Vote:

<i>Yes:</i>	1
<i>No:</i>	0
<i>Abstain:</i>	0
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<i>Total:</i>	1

Department Chair/ Designated Contact: Zachary Dowell (**Signed:** Mar 16, 2021)

Librarian: Rebecca Mendell (**Signed:** Mar 18, 2021)

Division Dean: Victoria Maryatt (**Signed:** Mar 16, 2021)

ARC Contact: Christopher Messier (**Unsigned**) *Requested: Mar 16, 2021*

CRC Contact: Brian Noel (**Unsigned**) *Requested: Mar 16, 2021*

SCC Contact: Jonathan Zeh (**Unsigned**) *Requested: Mar 16, 2021*