ADVM 0002A - COMPUTER AIDED DESIGN FOR MANUFACTURING PROCESSES

Catalog Description

Advisory: Not recommended to take concurrently with ADVM 0001A
Hours: 72 (18 lecture, 54 laboratory)
Description: This introductory course focuses on the fundamentals of parametric Computer Aided Design (CAD) for manufacturing applications. Students will learn to create fully defined sketches, parametric 3D part assembly models, using industry-standard CAD tools. The course provides an overview of how CAD models serve as the foundation for downstream processes, such as technical documentation, Computer-Aided Manufacturing (CAM), CNC machining, Additive Manufacturing (AM), and Printed Circuit Board (PCB) design. Emphasis is placed on developing essential modeling skills, understanding design intent, and recognizing how CAD data supports various stages of the manufacturing process. (not transferable)

Course Student Learning Outcomes

- CSLO #1: Apply parametric Computer Aided Design (CAD) principles to design and develop digital solid CAD models of product components and assemblies
- CSLO #2: Understand the integrated relationship between Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) technologies.
- CSLO #3: Create digital derivatives of CAD design data used for product realization and documentation.

Effective Term

Fall 2026

Course Type

Credit - Degree-applicable

Contact Hours

72

Outside of Class Hours

36

Total Student Learning Hours

108

Course Objectives

Lecture Objectives
1. Define parametric CAD
2. Describe the workflow to develop a Computer Aided Design (CAD) model in a parametric CAD software application
3. Discuss the central role of parametric CAD models and their derivatives in the product life cycle in the modern manufacturing enterprise
4. Identify major user interface modes in a parametric CAD software application
5. Recall the names, user interface icons, and functions of the sketch entity commands
6. Describe fully defined and constrained sketches
7. Describe the process used to modify basic CAD geometry form bodies
8. Recall the names, user interface icons, and functions of the solid feature creation commands
9. Describe the CAD solid modeling commands used to define model features
10. Recall the names, user interface icons, and functions of the surface feature creation commands
11. Describe the CAD solid modeling commands used to define model features
12. Recall the names, user interface icons, and functions of the sheet metal feature commands
13. Describe the CAD modeling commands used to define sheet metal model features
14. Recall the names, user interface icons, and functions of the assembly commands
15. Describe the distributed method of developing a CAD assembly model
16. Describe the derived methods of developing a CAD assembly model
17. Describe the process of creating detailed drawings as a derivative of a parametric CAD model
18. Recall the steps required to create a drawing format template
19. Define CAM
20. Recall the names, user interface icons, and functions of the electronics design commands
21. Describe the process of Electronics Schematic in a parametric CAD application
22. Describe the process used to create a Printed Circuit Board (PCB) from a Schematic
23. Recall the process used to generate files for PCB Manufacture from a model design
24. Describe the process of applying Computer Aided Manufacturing (CAM) toolpath to create Computer Numerical Control (CNC) code and machine setup sheets as a derivative of a parametric CAD model
25. Describe the process of creating a 3D printed model as a derivative of a parametric CAD model
26. Explain the basic principles of 3D Printing
27. Describe how slicing software processes a 3D CAD model
28. Describe how to import CAD Model Files
29. Describe the basic safe operation and best practices of 3D printers
30. Design process plan development for the manufacture of a part design
31. Recall the names, user interface icons, and functions of the 2-axis milling CAM commands
32. Explain the process to create milling tools for a digital CAM tool library
33. Describe CAM commands used to apply 2-axis milling toolpath to a CAD model
34. Recall the procedure to generate Computer Numerical Control (CNC) code from a CAM tool path operation
35. Recall the process to generate CNC machine set-up documentation for a CNC program
36. Recall the process used to simulate a CAM toolpath and stock material removal

Laboratory Objectives

1. Create fully defined and constrained sketches using sketch tools, dimensions, and entity relationships constraints
2. Create and modify basic Computer Aided Design (CAD) geometry form bodies
3. Create CAD entities using solid feature commands
4. Create CAD entities using surface commands
5. Use feature-based CAD modeling tools to define a part design
6. Use sheet metal CAD modeling tools to define a sheet metal part design
7. Create CAD Model part assemblies using both distributed and derived design strategies
8. Create parametric CAD model assemblies with mechanical motion
9. Create parametric CAD exploded view animations
10. Create CAD rendered images
11. Create detailed drawings from parametric CAD models
12. Create drawing format templates
13. Create an electronics schematic in a parametric CAD application
14. Generate a Printed Circuit Board (PCB) from a Schematic
15. Generate files for PCB Manufacture
16. Demonstrate how to import CAD Model Files for additive manufacturing
17. Perform slicing operations using a slicer software program
18. Demonstrate safe operation and best practices of 3D printing by creating a 3D printed part of a CAD model
19. Develop a process plan to machine a given part using 2-axis Computer Aided Manufacturing (CAM) strategies for milling processes
20. Create and manage a digital CAM tool library
21. Apply CAM tool path operation to a part model
22. Create post-processed Computer Numerical Control (CNC) code from a CAM tool path operation to run on a CNC machine
23. Create CNC machine set-up documentation for a CNC program
24. Use 2-axis CAM strategies to apply CNC toolpath to perform roughing and finishing routines for a given part design
25. Use CAM toolpath simulation to validate stock removal
26. Create the required CNC machine setup documentation for a CNC program

General Education Information

- Approved College Associate Degree GE Applicability
- CSU GE Applicability (Recommended-requires CSU approval)
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

Articulation Information

- Not Transferable

Methods of Evaluation

- Classroom Discussions
  - Example: Students will discuss the advantages of model distributive vs derivative parametric assembly modeling.
- Objective Examinations
  - Example: Students will take a multiple-choice test, evaluating their ability to recall the names of software commands when shown images of the related button icons from the graphical user interface.
- Projects
  - Example: Students will be evaluated on designing a 3D model using CAD software. Example: Model machined component from a technical drawing specification

Repeatable

No

Methods of Instruction

- Laboratory
- Lecture/Discussion
- Distance Learning

Lab:

1. The instructor will demonstrate how to use dimensions and geometric constraints to fully define a sketch in a CAD model, followed by student practice.

Lecture:

1. The instructor will lecture on the workflow to develop a Computer Aided Design (CAD) model in a parametric CAD software application, followed by students outlining the steps to develop a model in a parametic CAD software application

Distance Learning

1. Instructor provides a how-to tutorial on creating and applying CAM toolpath to a CAD model and output code for a CNC Milling Machine. Students are expected to follow the steps to apply the CAM toolpath correctly and upload the properly formatted CNC code in the Learning Management System assignment for evaluation.

Typical Out of Class Assignments

Reading Assignments

1. Based upon a recent article on CAM strategies from a trade magazine provided by the instructor, determine the most suitable method for machining specific features on a given part. 2. Based upon the assigned open source reading material, what would be the most desirable orientation to mount a given workpiece in a mill vise to reduce cutter-induced vibration, and why?

Writing, Problem Solving or Performance

1. Evaluate a given Computer Aided Design (CAD) Model for dimensional accuracy to a technical drawing; when discrepancies are found, resolve these errors through manipulation of the CAD model file to make it meet design specifications. 2. Draw an object to satisfy the supplied constraints that can be machined in a vise without custom tooling.

Other (Term projects, research papers, portfolios, etc.)

Required Materials

- Parametric Modeling with Autodesk Fusion 360
  - Author: Randy Shih
  - Publisher: SDC Publications, Inc.
  - Publication Date: 2021
  - Text Edition: 5th
  - Classic Textbook?: No

- OER Link:
- OER:

Other materials and-or supplies required of students that contribute to the cost of the course.