

TO: The Faculty of the College of Engineering

FROM: The Faculty of the School of Mechanical Engineering

RE: ME 16400 Geometric and Annotation Modeling – Permanent Course Number

The Faculty of the School of Mechanical Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

ME 16400 Geometric and Annotation Modeling, Sem 1, 2, cr. 3.

Prerequisites: None.

Course Description: This course focuses on CAD-based modeling and engineering graphics standards (national – ANSI/ASME and international – ISO), including coordinate and geometric dimensioning and tolerancing practices. It covers principles and techniques of three-dimensional surface and solid modeling. This course teaches students how to model real-world engineering objects and assemblies using the capabilities of commercial CAD systems. Conceptual, preliminary and detailed part and assembly models are assigned as exercises to reinforce the classroom lectures. This course teaches the graphics language and standards necessary for engineering students to read, understand, and sign off engineering drawings and documents. Students are required to detail (create engineering drawings) their CAD models, demonstrating their ability to both read and apply graphic standards.

History: This course has previously been offered as a ME 297 course titled “Graphics Communication and & spatial analysis - Principles and Applications” six times since Fall 2022. The student enrolment in the course was as follows:

- Fall 2022 with 30 students
- Spring 2023 with 29 students
- Fall 2023 with 200 students
- Spring 2024 with 48 students
- Fall 2024 with 200 students
- Spring 2025 with 108 students

Details of this course are outlined in the appended material below.



Jitesh Panchal
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Professor of Mechanical Engineering

ME 16400
Geometric and Annotation (CAD) Modeling

Course Outcomes

Individual

1. Improved sketching
2. Understand wireframe, surface and solid modeling techniques found in a modern commercial CAD package. [3]
3. Create CAD models of basic machine components and assemblies. [2]
4. Design and create CAD models of average to complex mechanical components. [2]
5. Understand the approaches and processes used in component and assembly modeling, i.e. top-down and bottom-up design. [2]
6. Read and understand engineering drawings composed of multiple views with standard dimensioning and tolerancing nomenclature. [3]
7. Read and understand engineering drawings that contain geometric dimensioning and tolerancing symbols. [3]
8. Use of standards for geometric modeling, dimensioning, and tolerancing. [2]

Team

1. Work in collaboration with fellow teammates to accomplish both the learning of the CAD tool and the executing of the modeling projects. [5]

Hand Sketching
2 wks

1. Visualization 2D to 3D, 3D to 2D
2. Orthographic Multiview Sketching
3. Axonometric and Oblique Sketching
4. Perspective

Mechanical Design
3 wks

1. Learning the Steps to Design
2. Learning Design Standards
3. Practicing Elements of the Design Process
4. Engineering Change and Release Process

CAD Modeling
6 wks

1. Wireframe/Sketch Modeling
2. Surface Modeling
3. Solid Modeling
4. Assembly Modeling
5. Standard Parts

Reading/Creating Drawings
5 wks

1. One view Part Drawings
2. Multiview Drawings
3. Sections and Auxiliary Views
4. Standard, Baseline, Ordinate Dimensioning & Tolerancing
5. Geometric Dimensioning & Tolerancing
6. Assembly Drawings

Course Lab Projects

- Lab 1: Open-ended Design, Modeling, Drafting, and Annotation of a Complex (typically solid) Mechanical or Aero Part.
- Lab 2: Open-ended Design, Modeling, Drafting, and Annotation of an Aesthetic/Aerodynamic (typically surfaced) Mechanical or Aero Part.
- Lab 3: Open-ended Design, Modeling, Drafting, and Annotation of a 20-30 Part Assembly requiring more than a dozen fits and mating conditions, etc.

COURSE NUMBER: ME 16400

COURSE TITLE: Geometric and Annotation Modeling (3 credits)

REQUIRED COURSE OR ELECTIVE COURSE: Required

TERMS OFFERED: Fall and Spring

TEXTBOOK: No required textbook.

Reference book: The Fundamentals of Visualization, Modeling, and Graphics for Engineering Design by Dennis Lieu (2008) 1st; Or any other Engineering Graphics book published by Gary Bertoline, Frederick Giesecke, or James Leake.

PRE-REQUISITES: None

COORDINATING FACULTY: C. Greg Jensen

COURSE DESCRIPTION: This course focuses on the principles and techniques of 3-dimensional surface and solid modeling. This course teaches students how to model real-world engineering objects and assemblies using the capabilities of commercial CAD systems. Conceptual, preliminary and detailed part and assembly models are assigned as exercises to reinforce the theoretical classroom lectures. This course teaches the graphics language and standards necessary for engineering students to read, understand and sign-off engineering drawings and documents. Students are required to detail (create engineering drawing) their CAD models, demonstrating their ability to both read and apply ASME and ISO graphic standards, including geometric dimensioning and tolerancing.

COURSE OUTCOMES:

Individual

1. Improved sketching
2. Understand wireframe, surface and solid modeling techniques found in a commercial CAD package.
3. Create CAD models of basic machine components and assemblies.
4. Design and create CAD models of average to complex mechanical components.
5. Understand the approaches and processes used in component and assembly modeling, i.e. top-down and bottom-up design.
6. Read and understand engineering drawings composed of multiple views with standard dimensioning and tolerancing nomenclature.
7. Read and understand engineering drawings that contain geometric dimensioning and tolerancing symbols.
8. Use of standards for geometric modeling, dimensioning, and tolerancing.

ASSESSMENTS TOOLS:

1. Quizzes, Exams (written and practical)
2. Homeworks
3. Lab Projects

Team

1. Work in collaboration with fellow teammates to accomplish both the learning of the CAD tool and the executing of the modeling projects.

PROFESSIONAL COMPONENT:

Engineering Design—3 credits

NATURE OF DESIGN CONTENT: Lecture materials cover the full mechanical design process with specific lectures, assignments and lab projects focused design specifications and requirements, conceptual, preliminary, and detailed design processes, and the creation of engineering and manufacturing drawings. Both a priori design planning and subsequent plan execution are used to reinforce the theory covered in lecture. Students are taught the processes to building robust reusable CAD models with associated dimensioning and tolerancing through the use a simple mechanical objects and parts. Then they are challenged to apply this knowledge and skill as they complete three open-ended design projects. They create three designs of their own making and produce all of the detailing/annotation artifacts to plan and make their designs in the subsequent Manufacturing Processes course.

RELATED ME PROGRAM OUTCOMES:

1. – Engineering Fundamentals
2. – Engineering Design
3. – Communication Skills
4. – Ethical/Prof. Responsibilities
5. – Teamwork
6. – Experimental Skills
7. – Knowledge Acquisition

COMPUTER USAGE: Use CAD Applications available in ME Computer Lab.

COURSE STRUCTURE/SCHEDULE:

Lecture – 2 days per week at 50 minutes each
Lab – 2 days a week at 110 minutes each

GRADING SCALE:

Course grade will be based on a straight grading scale: 97-100% A+; 93-97% A; 90-93% A-; 87-90% B+; 83-87% B; 80-83% B-; 77-80% C+; 73-77% C; 70-73% C-; 67-70% D+; 63-67% D; 60-63% D-; <60% F.

PREPARED BY: C. Greg Jensen

REVISION DATE: 8-Dec-25

