ME 170: Computer-Aided Design
Spring 2025

COURSE INFORMATION

Meeting times:

- Lecture: Tuesday / Thursday, 8-8:50am, Campus Instructional Facility (CIF) 0035
- Labs: One 2 hr lab per week, 1009 MEL (EWS Computer Lab)

Credit Hours: 3

Prerequisites: None

Textbook: No required textbook

CAD Software: (see Canvas for instructions on accessing CAD software)

- Autodesk's Fusion 360 (free educational license for PC or Mac)
- aPriori CAD integrated Design for Manufacture software (free access in 1009 MEL)

LEARNING OBJECTIVES

After completing this course, students will be able to:

- Use Mechanical Computer Aided Design (MCAD) through Autodesk's Fusion 360 collaborative CAD modeling environment
- Create professional Mechanical Engineering Drawings to national and international standards (ANSI/ASME Y14 series, ISO 286)
- Apply the Human Centered Design (HCD) process working in a design team
- Understand the principles of Design for Manufacture (DFM) and apply them in a group design project
- Examine and compare product costs with aPriori's CAD-integrated manufacturing cost analysis
- Apply the Product Design process from concept-to-customer

INSTRUCTOR

Dr. Kellie Halloran – kellie2@illinois.edu
Office hours: posted on Canvas
Location: 2138 Mechanical Engineering Lab

Communication policy: The best way to communicate with course staff is in person at office hours or before / after class, however you can email us and we will do my best to respond in a timely manner. Part of your university experience is learning to communicate. All emails should include your name and "ME 170" in the subject, and emails to Prof. Halloran should be addressed to "Dr. Halloran" or "Professor Halloran". **Any emails without "ME 170" and your name in the subject or any emails not following this format will not receive a response.**

GRADUATE TEACHING ASSISTANTS

SungGyu Chun – chun7@illinois.edu
Office hours: posted on Canvas
Lab sections: AB1, AB3

Liuyang Cheng – liuyang5@illinois.edu
Office hours: posted on Canvas
Lab sections: AB2, AB4, AB5

UNDERGRADUATE GRADERS

Undergraduate graders are students who have excelled in previous semesters of ME 170.

Office hours for graders are also posted on Canvas.

Adam Hauser – ahauser4@illinois.edu Lab section: AB1	**Manav Chopda** – mchopda2@illinois.edu Lab section: AB2
Aryan Shroff – aryans4@illinois.edu Lab section: AB3	**Arin Chaudhary** – ac124@illinois.edu Lab section: AB4
Henrique Teixeira – htt2@illinois.edu Lab section: AB5	

LAB SECTIONS

All labs meet for 2 hours in the EWS lab (1009 MEL).

	AB1	AB2	AB3	AB4	AB5
Day	Tues	Tues	Tues	Thurs	Thurs
Time	10am	1pm	3pm	1pm	3pm

COURSE TOPICS

1. **Design Process:** Human Centered Design (HCD), 2D/3D freehand concept sketching (isometric and orthographic), Product Design Specification (PDS), Concept Selection (Pugh), Rapid Prototyping/3D printing, Design for Manufacture (aPriori cost analysis)
2. **CAD:** 2D CAD, 3D wireframe, and 3D solids and surfaces
3. **Basic Part modeling:** setting up datum planes, defining the coordinate systems, feature selection, parent/child relationships, dimension driven 3D sketching (including protrusions, revolving, extruding etc.), visualization (hidden lines, shaded, and perspective views)
4. **Complex Parts and Surfaces:** Curved surfaces and blends, shelled/molded parts, adding ribs and bosses, sheet metal modeling, creating parametric designs (include. variables, equations, forms and tables)
5. **Engineering Drawings:** Orthographic projections, line and text forms, section and part- section views, dimensioning and tolerancing principles and standards (incl. GD&T), ISO standard limits and fits, and compliance with ANSI standards (ASME Y14 series).
6. **Assembly:** Assembly constraints (mating planes and coordinates, aligning, orienting etc), exploded views, creating a Bill of Materials (BOM), interference and clearance checking, orthographic assembly drawings.
7. **Engineering Property and File Creation:** mass/volume properties, plot/print files, web file creation (jpg, VRML), data exchange (IGES, STL, DXF), Mesh files (FEA output), and Cutter Location Files (toolpath generation)
8. **Introduction to Kinematics:** Fusion Motion Analysis; Creating Animations; simulating multi-axis joints, springs, servo and force motors.
9. **Design Project:** Design a small product or sub-assembly. Create part models for each part, Assembly models with exploded views, Bill of Materials (BOM), a full set of blueprints / engineering drawings and a physical prototype of one key part (on 3D printers).
10. **Professional Development:** Develop and give a computer presentation and write a design project report.
11. **Program advancement topics:** Ethical and Professional responsibilities of an engineer, working effectively in design teams; introduction to technical report writing.

TENTATIVE COURSE SCHEDULE

This course schedule is subject to change. For the most up to date schedule, see Canvas.

Week	Lectures		Labs	
	Topic	**Lecture Class Assignment** *3 days to complete*	**Fusion CAD Labs (CADLAB)** *1 week to complete*	**Team Design Project (TEAMPROJ)** *1 week to complete*
1 **1/20**	• Intro to ME 170, Fusion • Intro to Design	• LCA 1 (Th)	*No in-person labs during the first week of class*	
2 **1/27**	• DFM 1: Design for Manufacture (DFM) Intro, Injection molding • DFM 2: Sheet metal	• LCA 2 (T) • LCA 3 (Th)	*No CADLAB this week*	Problem Finding Activity during normal lab time
3 **2/3**	• Human-Centered Design (HCD) • DFM 3: Rapid prototyping, bar and tube	• LCA 4 (T) • LCA 5 (Th)	1: Intro to Fusion	0: Team Contract due in lab 1: HCD Interviews
4 **2/10**	• Ideation • Peer Mentoring Meeting 1 (2/13)	• LCA 6 (T)	2: Intro to Part Modeling	2: HCD Frameworks
5 **2/17**	• 2D/3D freehand sketching • Orthographic, isometric drawings	• LCA 7 (T) • LCA 8 (Th)	3: Multistep Part Modeling	4: Product Design Specifications
6 **2/24**	• Product Design Specifications • Concept selection, aPriori	• LCA 9 (T) • LCA 10 (Th)	4: Loft / Sweep Features, EIF	3: Ideation
7 **3/3**	• Engineering drawings • Engineering drawings	• LCA 11 (T) • LCA 12 (Th)	5: Creative Part Exercise	5: Pugh Concept Selection Matrix
8 **3/10**	• Peer Mentoring Meeting 2 (3/11) • Engineering drawings	• LCA 13 (Th)	6: Patterns / Model Modifications, aPriori	6: Start CAD Modeling
9 **3/17**	*No lecture or labs – Spring break*			
10 **3/24**	• Professional and ethical responsibilities of an engineer • Standard limits and fits (ISO/ASME)	• **Ethics Reflection *(1 week)*** • LCA 14 (Th)	7: Assembly Modeling	7: Part Modeling
11 **3/31**	• Standard limits and fits (ISO/ASME) • Overview of design project deliverables	• LCA 15 (T) • LCA 16 (Th)	8: Engineering Part Drawings	8: Assembly Modeling
12 **4/7**	• Process capability and tolerance analysis • Process capability and tolerance analysis	• LCA 17 (T) • LCA 18 (Th)	9: Mechanism Design / Animation	9: Engineering Part Drawings and tolerancing
13 **4/14**	• Geometric dimensions and tolerancing (GD&T) • Peer Mentoring Meeting 3 (4/17)	• LCA 19 (T)		10: Assembly Drawings, BOM, Animations
14 **4/28**	• *No Lectures – focus on design project*			Design Project Presentations
15 **5/5**	• Tues: course wrap up, reflections, final report overview		Final Reflection *Due Wed 5/14 by 11:59pm*	Final Project Reports *Due Fri 5/9 by 11:59pm*

GRADING

Lecture Class Assignments:	**Points**
• LCA#1 – LCA#19: 10 pts each of best 18 (worst one is dropped!)	**180**
• Lecture Attendance (iClicker) – 4 classes are dropped	**50**
CAD Labs:	
• CADLAB#1 - CADLAB#9: 30 pts each	**270**
• Problem Finding Lab Activity	**30**
• Lab Attendance	**50**
Team Design Project (Group Assignments):	
• TEAMPROJ#0 - TEAMPROJ#10: 10 pts each	**110**
• Design Project Presentation:	**60**
• Final Design Project Report:	**100**
• Participation Grade - Contribution to the team (CATME)	**50**
Class Reflections / Individual Assignments	
• ME 470 Mentoring Meetings (10 points each)	**30**
• Ethics Reflection: 30 pts	**30**
• Final Course Reflection: 40 pts	**40**
Total	**1000**

Grade Distribution:

A+ ≥ 97%	A ≥ 93%	A- ≥ 90%
B+ ≥ 87%	B ≥83%	B- ≥ 80%
C+ ≥ 77%	C ≥ 73%	C- ≥ 70%
D+ ≥ 67%	D ≥ 63%	D- ≥ 60%
F < 60%		

Late Assignments:

Grades for late assignments will be reduced by 10% per day, up to 50% **if submitted before the final day of classes**. There will be no extensions for Team Project assignments or CADLAB assignments as you have a week to complete both. This means it is a good idea to not wait until the last minute! Exceptions will only be made for extenuating circumstances lasting longer than 1 week (that cover the entire period form when the assignment was assigned to when it was due).

If you need an extension for an LCA or reflection due to illness, university affiliated trip, death in the family or some other unexpected event, please email the instructor or your TA and request an extension **before the deadline**, specifying the reason with documentation and proposing a revised due date. Acceptable documentation includes an official university letter or a doctor's note **with dates that you are excused**.

ATTENDANCE POLICY

Physical attendance is required. You will confirm your attendance in lecture using iClickers. Lecture Class Assignments (LCA) will be reviewed during each class and these assignments will need to be completed by the posted due date (generally within 3 days of the lecture). Extended absences over 3 days that prevent you from completing an LCA will require an official excuse letter, which can be obtained at https://odos.illinois.edu/resources/students/absence-letters.

If you are unable to attend lab or lecture due to quarantine, illness, university affiliated trip, death in the family or some other unexpected event, please notify us **before** the lecture or lab section.

OTHER POLICIES

COVID

Following University policy, all students are required to engage in appropriate behavior to protect the health and safety of the community. Students are also required to follow the campus COVID-19 protocols. Students who feel ill must not come to class. In addition, students who test positive for COVID 19 or have had an exposure that requires testing and/or quarantine must not attend class.

The University will provide information to the instructor, in a manner that complies with privacy laws, about students in these latter categories. These students are judged to have excused absences for the class period and should contact the instructor via email about making up the work.

Students who fail to abide by these rules will first be asked to comply; if they refuse, they will be required to leave the classroom immediately. If a student is asked to leave the classroom, the non-compliant student will be judged to have an unexcused absence and reported to the Office for Student Conflict Resolution for disciplinary action. Accumulation of non-compliance complaints against a student may result in dismissal from the University

Emergency Response Recommendations

Emergency response recommendations can be found at the following website: http://police.illinois.edu/emergency-preparedness/. I encourage you to review this website and the campus building floor plans website within the first 10 days of class: https://police.illinois.edu/em/building-emergency-action-plans/.

Sexual Misconduct Reporting Obligation

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX Office. In turn, an individual with the Title IX Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: https://wecare.illinois.edu/resources/students/#confidential. Other information about resources and reporting is available here: https://wecare.illinois.edu.

Academic Integrity

You are expected uphold the highest ethical standards, to be honest, and to practice academic integrity. **This includes doing original work and citing all sources**, including the work of other students. If an AI tool is used, it should be only for final Please give special care to prepare high-quality submissions with proper grammar and spelling. The University of Illinois at Urbana-Champaign Student Code should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code at the following URL: http://studentcode.illinois.edu/. Academic dishonesty may result in a failing grade.

Every student is expected to review and abide by the Academic Integrity Policy: https://studentcode.illinois.edu/article1/part4/1-401/. Ignorance is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.

Use of Generative AI Technology

Generative AI, such as OpenAI ChatGPT, Microsoft Copilot/Bing Chat, Google Gemini, and others, can answer questions and generate text, images, and media. The appropriate use of generative AI will vary from course to course. Guidelines for using generative AI *in this course* are as follows:

1. Follow only the specific permitted uses set by your instructor.
2. Document and attribute all AI contributions to your coursework.
3. Take full responsibility for AI contributions, ensuring the accuracy of facts and sources.

Permitted uses of generative AI in this course include:

- Revising your own text for spelling and grammar
- Testing and practicing your knowledge of course topics
- Conducting basic research on course and assignment topics

The use of generative AI tools is **not permitted** in this course for the following activities:

- Impersonating you in classroom contexts, such as by using the tool to compose discussion board prompts assigned to you or content that you put into a Zoom chat.
- Completing group work that your group has assigned to you, unless it is mutually agreed upon that you may utilize the tool.
- Writing a draft of a writing assignment.
- Writing entire sentences, paragraphs or papers to complete class assignments.
- Creating any images or sketches of product designs for group design projects and other assignments. All images used in presentations, assignments, labs, and must be created by you (digital sketch or handwritten) and they cannot be AI-generated.

Additional allowed uses and restrictions may apply to specific assignments as specified in that assignment's instructions.

When using generative AI, keep a journal documenting prompts, AI responses, and your usage, or, if possible, share a link to your chat history. You should be ready to provide this documentation if or when you are asked by your instructor.

Refer to the APA style guide for citing generative AI, including the text of your prompt to the AI. Remember, a generative AI conversation in and of itself is not a valid source for facts. Always work to find, verify, and cite the original source of ideas, rather than citing the AI directly. Review the University of Illinois System's Generative AI Guidance for Students. You are responsible for verifying sources and facts and attributing ideas generated by the AI. Generative AI tools sometimes invent facts and sources.

Failure to abide by these guidelines is a violation of academic integrity. We will investigate suspected uses of generative AI that do not follow these guidelines and apply sanctions as outlined in the Illinois Student Code.

Religious Observances

Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance, and the scheduling of examinations and work requirements. You should examine this syllabus at the beginning of the semester for potential conflicts between course deadlines and any of your religious observances. If a conflict exists, you should notify your instructor of the conflict and follow the procedure at https://odos.illinois.edu/community-of-care/resources/students/religious-observances/ to request appropriate accommodations. This should be done in the first two weeks of classes.

Disability-Related Accommodations

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 333-4603, email disability@illinois.edu or go to https://www.disability.illinois.edu. If you are concerned you have a disability-related condition that is impacting your academic progress, there are academic screening appointments available that can help diagnosis a previously undiagnosed disability. You may access these by visiting the DRES website and selecting "Request an Academic Screening" at the bottom of the page.

Family Educational Rights and Privacy Act (FERPA)

Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See https://registrar.illinois.edu/academic-records/ferpa/ for more information on FERPA.

Anti-Racism and Inclusivity Statement

The Grainger College of Engineering is committed to the creation of an anti-racist, inclusive community that welcomes diversity along a number of dimensions, including, but not limited to, race, ethnicity and national origins, gender and gender identity, sexuality, disability status, class, age, or religious beliefs.

The College recognizes that we are learning together in the midst of the Black Lives Matter movement, that Black, Hispanic, and Indigenous voices and contributions have largely either been excluded from, or not recognized in, science and engineering, and that both overt racism and micro-aggressions threaten the well-being of our students and our university community.

The effectiveness of this course is dependent upon each of us to create a safe and encouraging learning environment that allows for the open exchange of ideas while also ensuring equitable opportunities and respect for all of us. Everyone is expected to help establish and maintain an environment where students, staff, and faculty can contribute without fear of personal ridicule, or intolerant or offensive language. If you witness or experience racism, discrimination, micro-aggressions, or other offensive behavior, you are encouraged to bring this to the attention of the course director if you feel comfortable. You can also report these behaviors to the Bias Assessment and Response Team (BART) (https://bart.illinois.edu/). Based on your report, BART members will follow up and reach out to students to make sure they have the support they need to be healthy and safe. If the reported behavior also violates university policy, staff in the Office for Student Conflict Resolution may respond as well and will take appropriate action.