UNIVERSITY OF CALIFORNIA
Mechanical Engineering Department

E 26 **Three Dimensional Modeling for Design** **Spring 2021**

Faculty: Dr. Ken Youssefi
Office: 5106 Etcheverry Hall, email: kyoussefi@aol.com
Office Hours: Tu. 10:00 – 11:00 online (Zoom office hours)
Class website: http://bcourse.berkeley.edu (use CalNet ID and password to login)
Final Exam: Wednesday May 12, 11:30-2:30

Course Description:

Three-dimensional modeling for engineering design. This course will emphasize the use of CAD on computer workstations as a major graphical analysis and design tool. Students develop design skills, and practice applying these skills. A group design project, design and fabrication (3D print) of the tower and rotor is required. Hands-on creativity, teamwork, and effective communication are emphasized.
2 units, one hour lecture and 2 hours lab. No prerequisite

Lecture: Tuesday 9:00 – 10:00, online, zoom meeting

Laboratory:	section 101:	Wed.	4:00 – 6:00, online (live zoom)	GSI - Artos
	section 102:	Th.	1:00 – 3:00, online (live zoom)	GSI - Jessica
	section 103:	Fri.	11:00 – 1:00, online (live zoom)	GSI - Artos

Graduate Student Instructors (GSI): Artos Cen, **artoscen@berkeley.edu,** and Jessica Yuan**, jessica.y2020@berkeley.edu**

CAD software and Textbooks:

Required
SolidWorks 2020/21, free download, instruction is on bCourse

Recommended,
Lieu, D.K., and Sorby, S.A., Visualization, Modeling, and Graphics for Engineering Design, Cengage Publishers, 2015

Course Objective
Introduce computer-based solid, parametric, and assembly modeling as a tool for engineering design; enhance critical thinking and design skills; emphasize communication skills, both written and oral; develop teamwork skills; offer experience in hands-on, creative engineering projects; reinforce the societal context of engineering practice; develop early abilities in identifying, formulating, and solving engineering problems.

Semester Project
Wind turbine project: rotor blade and tower design, digital prototype. See project description.

Grading: 35% Laboratory work, 35% Examination (CAD), 30% Design Project,
Letter grade distribution

A+	**98-100%**	**B+**	**87-89%**	**C+**	**77-79%**	**D+**	**67-69%**
A	**92-97%**	**B**	**82-86%**	**C**	**72-76%**	**D**	**62-66%**
A-	**90-91%**	**B-**	**80-81%**	**C-**	**70-71%**	**D-**	**60-61%**
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Student Learning Objectives

Upon completion of the course, students shall be able to:

- Create a 3D solid model of a complicated object with high degree of confidence.
- Extract 2D orthographic views from the 3D model for fabrication.
- Specify the proper dimensions, according to industry standards, for parts to be fabricated
- Extract section and auxiliary views.
- Understand the basics of assembly and associative constraints.
- Understand the basics of rapid prototyping, in particular 3D printing
- Understand the engineering design process and the implementation of different design phases.
- Work effectively as a member of a design team.

Weekly laboratory and homework assignments

All labs will be live via Zoom. The lab period is 2 hours. During the labs, students will start by doing step-by-step solid modeling tutorials to learn different functionality. Then they will be given the lab assignment where they will apply what they've learned to model new geometries, assemblies, and products. There will be a focus on learning how to build a solid model to capture design intent and meaningful dependencies for ease of subsequent editing (project). You should be able to finish most of the lab assignment during the lab. If not, you must finish it before coming to the lab the following week (see due dates on syllabus or bCourse). Students will also learn how to set up for a 3D-print build, and 3D-print a geometry they design themselves. Homework problems will cover the theory behind the software, such as constraints and Booleans, and additional modeling problems that build on skills acquired during lab.

Lab assignments are due on Tuesdays by 11:59 pm. The due dates are indicated in the course syllabus and on bCourse.

Academic Honesty

All students should be familiar with the Code of Student Conduct and know that the general rules and students rights stated in the document apply to this class (see http://uga.berkeley.edu/SAS/osc.htm). With regard to laboratory work and homework assignments, not only are you allowed, but you are encouraged, to discuss the problems and techniques with other students; **but each student must do his or her version of the solution**. Submitting someone else's work as your own or knowingly allowing someone else to turn in your work as their own will result in a zero grade for the assignment for all involved and will be reported to the Office of Student Conduct. Cheating on the examinations will result in a failing grade in the course and your action will be reported to the Office of Student Conduct for administrative review.

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Zoom Classroom Etiquette

- If possible have your webcam on during the lecture. Or at least have your picture as the background. **The webcam is required for the final exam**.
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- Position Your Camera Properly: Be sure your webcam is in a stable position and focused at eye level.

- Mute Your Microphone: To help keep background noise to a minimum, make sure you mute your microphone when you are not speaking.

- Be Mindful of Background Noise and Distractions: Find a quiet place to "attend" class, to the greatest extent possible.

    ○ Avoid video setups where people may be walking behind you, people talking/making noise, etc.
    ○ Avoid activities that could create additional noise, such as shuffling papers, listening to music in the background, etc.

- Limit Your Distractions/Avoid Multitasking: You can make it easier to focus on the meeting by turning off notifications, closing or minimizing running apps, and putting your smartphone away (unless you are using it to access Zoom).

- Use Appropriate Virtual Backgrounds: If using a virtual background, it should be appropriate and professional and should NOT suggest or include content that is objectively offensive or demeaning. Make sure your name and your picture is displayed.

Technical difficulties

Internet connection issues: Canvas (bCourse) autosaves responses a few times per minute as long as there is an internet connection. If your internet connection is lost, Canvas will warn you but allow you to continue working on your exam. A brief loss of internet connection is unlikely to cause you to lose your work. However, a longer loss of connectivity or weak/unstable connection may jeopardize your exam.

Other technical difficulties: Immediately email the instructor a current copy of the state of your work/exam and explain the problem you are facing. Your instructor may not be able to respond immediately or provide technical.

Course Policies

Inclusion: We are committed to creating a learning environment welcoming of all students that supports a diversity of thoughts, perspectives and experiences, and respects your identities and backgrounds (including race/ethnicity, nationality, gender identity, socioeconomic class, sexual orientation, language, religion, ability, etc.) To help accomplish this:

- If you have a name and/or set of pronouns that differ from those that appear in your official records, please let us know.
- If you feel like your performance in the class is being impacted by your experiences outside of class (e.g., family matters, current events), please don't hesitate to come and talk with us. We want to be resources for you.

- We (like many people) are still in the process of learning about diverse perspectives and identities. If something was said in class (by anyone) that made you feel uncomfortable, please talk to us about it. You may also contact the ME department's Vice Chair for Equity & Inclusion, Professor Grace O'Connell (g.oconnell@berkeley.edu) or Staff Student Services for Equity and Inclusion, Ricky Vides (rickyv72@berkeley.edu). For ME specific resources for Equity & Inclusion please visit our website: https://me.berkeley.edu/about/equity-and-inclusion/
- As a participant in this class, recognize that you can be proactive about making other students feel included and respected.

Berkeley honor code: Everyone in this class is expected to adhere to this code: "As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others."

Academic honesty: You are encouraged to form study groups and work together to understand course material, but all written work and CAD models as well as responses to in-class questions should be your own. You may not copy other students' work. Academic integrity and ethical conduct are of utmost importance in the College of Engineering and at U.C. Berkeley.

Accommodation policy: We honor and respect the different learning needs of our students, and are committed to ensuring you have the resources you need to succeed in our class. If you need religious or disability-related accommodations, if you have emergency medical information you wish to share with us, or if you need special arrangements in case the building must be evacuated, please share this information with us as soon as possible. You may speak with either instructor privately after class or during office hours. Also see DSP under "Resources".

Resources

Center for Access to Engineering Excellence (CAEE)

The Center for Access to Engineering Excellence (227 Bechtel Engineering Center; https://engineering.berkeley.edu/student-services/academic-support) is an inclusive center that offers study spaces, nutritious snacks, and tutoring in >50 courses for Berkeley engineers and other majors across campus. The Center also offers a wide range of professional development, leadership, and wellness programs, and loans iclickers, laptops, and professional attire for interviews.

Disabled Students' Program (DSP)

The Disabled Student's Program (260 César Chávez Student Center #4250; 510-642-0518; http://dsp.berkeley.edu) serves students with disabilities of all kinds. Services are individually designed and based on the specific needs of each student as identified by DSP's Specialists.

Counseling and Psychological Services

The main University Health Services Counseling and Psychological Services staff is located at the Tang Center (http://uhs.berkeley.edu; 2222 Bancroft Way; 642-9494)

and provides confidential assistance to students managing problems that can emerge from illness such as financial, academic, legal, family concerns, and more.

To improve access for engineering students, a licensed psychologist from the Tang Center also holds walk-in appointments for confidential counseling in 241 Bechtel Engineering Center (check here for schedule: https://engineering.berkeley.edu/student-services/advising-counseling).

The Care Line (PATH to Care Center)
The Care Line (510-643-2005; https://care.berkeley.edu/care-line/) is a 24/7, confidential, free, campus-based resource for urgent support around sexual assault, sexual harassment, interpersonal violence, stalking, and invasion of sexual privacy. The Care Line will connect you with a confidential advocate for trauma-informed crisis support including time-sensitive information, securing urgent safety resources, and accompaniment to medical care or reporting.

Ombudsperson for Students
The Ombudsperson for Students (102 Sproul Hall; 642-5754; http://students.berkeley.edu/Ombuds) provides a confidential service for students involved in a University-related problem (academic or administrative), acting as a neutral complaint resolver and not as an advocate for any of the parties involved in a dispute. The Ombudsman can provide information on policies and procedures affecting students, facilitate students' contact with services able to assist in resolving the problem, and assist students in complaints concerning improper application of University policies or procedures. All matters referred to this office are held in strict confidence. The only exceptions, at the sole discretion of the Ombudsman, are cases where there appears to be imminent threat of serious harm.

UC Berkeley Food Pantry
The UC Berkeley Food Pantry (#68 Martin Luther King Student Union; https://pantry.berkeley.edu) aims to reduce food insecurity among students and staff at UC Berkeley, especially the lack of nutritious food. Students and staff can visit the pantry as many times as they need and take as much as they need while being mindful that it is a shared resource. The pantry operates on a self-assessed need basis; there are no eligibility requirements. The pantry is not for students and staff who need supplemental snacking food, but rather, core food support.

Course Schedule

Week	Dates	Topics	**Lab. work** Assignments
1	1/19	Introduction to the course and the design project **No labs on Wednesday, Thursday and Friday this week**	**All assignments are due on Tuesdays by 11:59 pm**
2	1/26	Introduction to 3D modeling Parametric modeling, feature-based modeling, Design Intent	Lab. work #1 – **due Tu. 2/2 by 11:59 pm** Sketching & Extrusion
3	2/2	Solid modeling commands: Sketching Extrusion, Revolve, fillet, pattern, …	Lab. work #2 – due Tu. 2/9 by 11:59 pm Extrusion & Revolve
4	2/9	Solid Modeling: reference geometry Sweep and Loft commands	Lab. work #3 – due Mon. 2/16 by 11:59 pm Sweep
5	2/16	Assembly modeling; Top-down and bottom-up Mates in assembly, exploded view	Lab. work #4 – due Tu. 2/23 by 11:59 pm Loft
6	2/23	Advanced modeling: splines, 3D sketching Derived Curve, Curve Through points	Lab. work #5–due Mon. 3/2 by11:59 pm Assembly & Explodes views
7	3/2	Wind turbine tower structure design Stiffness and strength consideration	Lab. work #6–due Tu. 3/9 by11:59 pm Bicycle handle, spring
8	3/9	Extracting 2D views from the 3D solid model Dimensioning standards and conventions	Lab. work #7–due Tu. 3/16 by11:59 pm Top hat, wavy spring, 3D spring
9	3/16	Engineering analysis with SolidWorks work on the tower design, upload a freehand Introduction to Finite Element Analysis	Lab work #8- due Tu. 3/30 by 11:59 pm **upload a design concept for each member of the group (3D hand sketches)**
10	3/22 – 3/26	***Spring Break***	
11	3/30	Finite Element Analysis (FEA) cont. Finite Element problem – optimization	Lab. work #9–due Tu. 4/6 by 11:59 pm Shop drawing & section view
12	4/6	Stress and deflection of the wind turbine Tower and project discussion	Lab. work #10–due Tu. 4/13 by 11:59 pm FEA problem - optimization
13	4/13	Introduction to Rapid Prototyping	Lab work #11-due Tu. 4/20 by 11:59 pm

		Three Dimensional printing	FEA problem – stress analysis (wrench)
14	4/20	3D printing: FDM, STL, laser, ..	Lab. work #12 – due Tu. 4/27 by 11:59 pm
	Trombone	Material: liquid and solid polymer, powder metal, ceramic,… Advantages and limitations	
15	4/27	Engineering Design Process: project discussion	Lab. work #13 – work on the project
		Concurrent Engineering Design	tower design
		And project discussion, perform deflection analysis on your tower	
16	5/3 – 5/7	Reading/Review/Recitation (RRR) week - no lecture and lab **Wind turbine tower report is due Friday 5/7 by 11:59, upload your Solidworks file and the report to bCourse**	

Final Exam (SolidWorks) – Wed. May 12, 11:30 – 2:30 (no alternative exam date/time

Project Report–Due Friday May 7 by 11:59, upload SW prt. file and the report to bCourse.

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