UNIVERSITY OF CALIFORNIA
Mechanical Engineering Department

E 26 **Three Dimensional Modeling for Design** **Spring 2020**

Faculty: Dr. Ken Youssefi
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Office Hours: Tu 9:30 – 12:00
Class website: http://bcourse.berkeley.edu (use CalNet ID and password to login)

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 is required. Hands-on creativity, teamwork, and effective communication are emphasized. 2 units, no prerequisite

Lecture: Tu 8:10 – 9:00, 100 Genetics & Plant Bio (28466)

Laboratory:	section 101	Wed.	11:00 – 1:00	10 Jacobs (28467)	GSI -
	section 102	Th.	1:00 – 3:00	10 Jacobs (28468)	GSI -
	section 103	Fri	1:00 – 3:00	10 Jacobs (28783)	GSI -

Graduate Student Instructors (GSI): Maria Echeverria ***miecheverria@berkeley.edu***
,
Jialiang (Artos) Cen, ***artoscen@berkeley.edu***

Textbooks:

Recommended,

Required
SolidWorks 2019/20, free download with the SEK ID, will be provided in the class
Fusion 360, free download from Autodesk.com

Recommended,
Lieu, D.K., and Sorby, S.A., Visualization, Modeling, and Graphics for Engineering Design, Cengage Publishers, 2009

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 project; making a prototype using 3D printing; develop early abilities in identifying, formulating, and solving engineering problems

Semester Project
Wind turbine project: rotor blade and tower design and fabrication (3D print). See project description

Grading: 30% Laboratory work, 30% Examination (CAD), 30% Design Project, 10% participation
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 held in room 10 Jacobs. 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. 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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Course Schedule

Week	Dates	Topics	**Lab. work** Assignments
1	1/21	Introduction to the course Introduction to design project	**No lab this week (Wed. Th. and Fri.)**
2	1/28	Introduction to 3D modeling Parametric modeling, feature-based modeling, Design Intent	Lab. work #1 – due Tu. 2/4 by 11:59 pm Sketching & Extrusion
3	2/4	Solid modeling commands: Sketching, Extrusion , Revolve, fillet, pattern, …	Lab. work #2 – due Tu. 2/11 by 11:59 pm Extrusion & Revolve
4	2/11	Solid Modeling: reference geometry Sweeps and Lofts	Lab. work #3 – due Tu. 2/18 by 11:59 pm Sweep
5	2/18	Aerodynamics of wind turbine Rotor blade design, angle of attack, profile,…	Lab. work #4 – due Tu. 2/25 by 11:59 pm Loft
6	2/25	Wind turbine tower structure design Stiffness and strength consideration	Work on the blade design as a group, turn in 2-3 pages of your concept (sketches-one for each member) before leaving the lab (20points)
7	3/3	Assembly modeling; Top-down and bottom-up Mates in assembly, exploded view	Lab. work #5 – due Tu. 3/10 by 11:59 pm Assembly and Exploted views
8	3/10	Extracting 2D views from the 3D solid model Dimensioning standards	Lab. work #6 – due Tu. 3/17 by 11:59 pm Shop drawings, dimensioning and section view
	3/12	**Blade design due by Th. 3/12 midnight, email the .stl file to me at kyoussefi@aol.com**	
9	3/17	Introduction to Rapid Prototyping 3D printing: Limitations and advantages	Work on the tower design (group) and turn in 3-4 pages of your concept designs (sketches-one for each member) before leaving the lab (20 pts)
10	**3/23 – 3/27**	***Spring Recess***	
11	3/31	Rapid Prototyping: FDM, Stereolithography Laser, .. Material: liquid and solid polymer, powder, paper, metal, ceramic,… (tower design)	Lab. work #7 – due Tu. 4/7 by 11:00 pm Bicycle handle and screw driver design
12	4/7	3D printing cont. Project discussion (tower design)	Lab. work #8 – due Tu. 4/14 by 11:00 pm Soap and Spring design
Wind turbine design structure due by Th. 4/9 midnight, email the .stl file to me at kyoussefi@aol.com			
13	4/14	Engineering analysis with SolidWorks Introduction to Finite Element Analysis	Lab. work #9 – due Tu. 4/21 by 11:00 pm **Fusion 360** Sketching & Extrusion
14	4/21	Stress and deflection of the wind turbine tower Simulation using SolidWorks	Lab. work #10 – due Tu. 4/28 by 11:00 pm **Fusion 360** Revolve, Sweep & Loft
15	4/28	Engineering Design Process; Concurrent Engineering Design	Lab. work #11 – due Tu. 5/5 by 11:00 pm **Fusion 360** Assembly and Exploded views

		Tower construction (Gluing)
16	5/5	Reading/Review/Recitation (RRR) week - no class
		Wind turbine testing is scheduled for Tu May 5 from 9-12 and 1-4 in Hesse Hall basement

Final Exam (SolidWorks) – Th. May 14, 1:00-3:30, 4:00-6:30 and 7:00-9:30pm, 10 Jacobs

You will be assigned to take the exam in one of the above time slots

Project Report, hard copy (One report per group)–Due Th May 14 at the final exam

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