UNIVERSITY OF CALIFORNIA
Mechanical Engineering Department

E 26 **Three Dimensional Modeling for Design** **Fall 2019**

Faculty: Dr. Ken Youssefi
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Office Hours: TuTh. 11:10 – 1:00
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, 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 8:00 – 9:00, 105 Stanley

Laboratory:	section 101:	Wed.	5:00 – 7:00	10 Jacobs	GSI - Maria
	section 102:	Th.	3:00 – 5:00	10 Jacobs	GSI - Maria
	section 103:	Fri.	12:00 – 2:00	10 Jacobs	GSI - Jackie

Graduate Student Instructors (GSI): Maria Echeverria, **miecheverria@berkeley.edu**, and Jackie First, **jacquelynfirst@berkeley.edu**

CAD software and Textbooks:

Required
SolidWorks 2019/20, free download with the SDK 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 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 and fabrication (3D print). 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 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 (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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Course Schedule

Week	Dates	Topics	Lab. work Assignments
1	8/28	No labs on Wednesday, Thursday and Friday this week	
2	9/3	Introduction to the course Introduction to design project	Lab. work #1 – due Tu. 9/10 by 11:59 pm Sketching & Extrusion
3	9/10	Introduction to 3D modeling Parametric modeling, feature-based modeling, Design Intent	Lab. work #2 – due Tu. 9/17 by 11:59 pm Extrusion & Revolve
4	9/17	Solid modeling commands: Sketching, Extrusion, Revolve, fillet, pattern, …	Lab. work #3 – due Tu. 9/24 by 11:59 pm Sweep
5	9/24	Solid Modeling: reference geometry Sweeps and Lofts	Lab. work #4 – due Tu. 10/1 by 11:59 pm Loft
6	10/1	Aerodynamics of wind turbine Rotor blade design, angle of attack, profile, …	Work on the blade design as a group and turn in 2-3 p. of concept designs (sketches, one from each member) at the end of the lab. period (20 pts)
7	10/8	Wind turbine tower structure design Stiffness and strength consideration	Lab. work #5 – due Tu. 10/15 by 11:59 pm Bicycle handle, screwdriver & spring
8	10/15	Assembly modeling; Top-down and bottom-up Mates in assembly, exploded view views	Lab. work #6–due Mon. 10/22 by11:59 pm Assembly & Explodes
9	10/22	Extracting 2D views from the 3D solid model. Dimensioning standards and conventions	Lab. work #7–due Tu.10/29 by 11:59 pm Shop drawing and soap
		Blade design due by Th. 10/24 11:00 pm, email the .stl file to me at kyoussefi@aol.com	
10	10/29	Introduction to Rapid Prototyping Three Dimensional printing	Work on the tower design, as a group, turn in 2-3 pages of your concept designs (sketches) before leaving lab (20 pts)
11	11/5	3D printing: FDM, STL, laser, .. Material: liquid and solid polymer, powder, metal, ceramic,…Advantages and limitations	Lab. work #8 – due Tu. 11/12 by 11:59 pm **Fusion 360** Sketching and Extrusion
12	11/12	Engineering analysis with SolidWorks Introduction to Finite Element Analysis	Lab. work #9 – due Tu. 11/19 by 11:59 pm **Fusion 360** Revolve, Sweep & Loft
		Wind turbine design structure due by Th. 11/14, 11:00 pm, email the .stl files to me at kyoussefi@aol.com	
13	11/19	Finite Element Analysis (FEA) cont. Project discussion	Lab. work #10 – due Tu. 11/26 by 11:59 pm **Fusion 360** Shop drawing & section views
14	11/26	Stress and deflection of the wind turbine tower Simulation using SolidWorks	**Thanksgiving holiday** **No labs this week**
15	12/3	Engineering Design Process: Concurrent Engineering Design **Tower construction (Gluing)**	Lab. work #11 – due Mon. 12/9 by 11:59 pm **Fusion 360** Assembly & Exploded views
16	12/9-12/13	Reading/Review/Recitation (RRR) week - no class	
		Wind turbine testing is scheduled for Tu. Dec. 10 from 9-12 and 1-4 in Hesse Hall basement	

Final Exam (SolidWorks) – Wed. Dec. 18, 12:00–2:30, 3:00–5:30 and 6:00–8:30pm, all 3 exam slots will be in 10 Jacobs. You will be assigned to take the exam in one of the slots.

Project Report (One report per group)–Due Wed. Dec. 18 at the final exam

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