ENGR-057: Statics and Dynamics Fall 2021

Tuesdays, and Thursdays 10:30 am – 11:45 am

Final Exam Saturday December 11, 2021. 3:00 pm – 6:00 pm

Instructor

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Office Location: SE2-205 (or) Setup Zoom Appointment
Office Hours: Tuesday & Thursdays 3:00 pm -4:00 pm or by appointment.
Do not hesitate to email me and theTA---often confusion can be cleared up quickly, and without waiting for office hours!

TA

The Teaching Assistants (TA) is a critical part of the teaching team. You will be spending considerable time with this individual, both in discussion/lab and in office hours. Teaching Assistant is there to support your learning.

Marie Buhl
mbuhl@ucmerced.edu
Office Location: Student desk Opposite to SRE 211
Office Hours: Monday & Tuesday 2:00 -3:00 pm

Lecture

Tuesdays, and Thursdays @ 10:30 am – 11:45 am in COB2 -170 @UCM. Occasionally as needed, lecture may continue using zoom.

Lectures are used as a time to introduce the theoretical foundation of Statics and Dynamics. An important aspect of this introduction is clearly defining the assumptions and limits of the relationships. Students are encouraged to ask questions throughout the lecture. Examples of the application in engineering analysis are presented.

Discussion/Lab

ENGR 057 -11D Fridays @ 10:30 am – 11:20 am in ADMIN 353
ENGR 057 -12D Fridays @ 11:30 am – 12:20 pm in ADMIN 250
ENGR 057 -13D Fridays @ 12:30 pm – 01:20 pm in ADMIN 250

Theory and applications are complemented by demonstrations, hands-on exercises, and labassignments. Lab write-ups must be turned in at the end of class. The labs endeavor to give students a hands-on feel for both quantities and concepts. In addition, the labs get students working in small groups.

Discussion/labsare often highly interactive with your classmates and your TAs, so you are asked to come prepared to participate (as described below).

Team Learning in Lab/discussion Sessions.

Most discussion/lab during this course will include a team learning activity, in which you will cooperate in working on a problem with your team. Cooperative activities offer several advantages for achieving the course outcomes and are also good preparation for your future responsibilities as a professional, whether in engineering or another field.

Several benefits team learning as well as guidelines for routines we will follow during teamlearning in class are described here.

Benefits from Team Learning: Research conducted over the past 70 years has demonstratedseveral advantages that can result from small-group problem solving:

- **1+1>1**. Pooling resources provides advantages over working individually. The benefits come about only when the team members make genuine efforts to cooperate and communicate, and the payoff can be quite substantial for both team members and for individuals.
- **Deeper, "metacognitive" learning.** The main advantage from team learning emerges during the social interaction, when team members discuss and explain their thinking about how to approach a problem. Metacognition means "thinking about your thinking," which is viewed as an important skill by many companies today. Team learning can seem inefficient because it takes time for others to discuss their thinking, but this reflection – slowing down to review your work – is essential for deeper learning.
- **Social motivation**. Working with another person can often times be more engaging and rewarding than working in isolation. The more experience you have with cooperative learning, the greater the motivational advantages. Not to mention, that team learning canbe fun!

Guidelines for Team Learning: To benefit the most from team learning in class, it is important to keep these guidelines in mind:

- **Be sure that all team members are on board.** Introduce yourself! Before starting to work on a new and/or complex problem, all team members must connect with one another and agree on roles.
- **Plan of Action**: **Review, Record, Reflect, Report**. When working individually, a common approach is to simply dive into the problem. However, the "four R's" are the roles that need to be handled during problem solving, whether when working as an individual or as part of a team. In Team Learning, the routine includes development of a plan: Deciding on roles, laying out a timeline, taking notes, and deciding on who will take the responsibility for reporting when the job is finished. These activities are an essential part of the job of a professional engineer.

For more details regarding lab/discussion see class calendar.

Course Description

For many students ENGR_057 is their first formal introduction to engineering analysis. Therefore, the course aims not only to have students learn the mechanics of analysis but also to see its broader application in the engineering professions. The course may also serve to aid in decision-making about pursuing an engineering major.

This class is divided into two sections. **The first half** of this course will cover Statics: equilibriumof 2D/3D force systems; computations of reactions and internal forces; determinations of centroids and moments of inertia; introduction to vector mechanics. **The second half** of the course will cover the kinematics and equations of motion of a particle for rectilinear and curvilinear motion; planar kinematics of rigid bodies; kinetics for planar motion of rigid bodies, including equations of motion and principles of energy and momentum.

Course Objectives and Student Learning Outcomes

Students completing this course will develop problem solving skills in engineering mechanics through the application of concepts in statics and dynamics to complex problems. During the semester you will develop an understanding of the fundamentalsand principles of engineering mechanics: statics and dynamics of particles and rigid bodies in two and three dimensions including: kinematics and kinetics of particles, and rigid bodies in 2Dand 3D motion, rotations,

translations, and oscillations. You will also learn to solve equilibriumof rigid bodies including the calculations of moment of force, inertia moments of solid bodies, and basic structural analysis, and be able to determine the requirement for the equilibrium of particles and solid bodies. Finally, students will develop the ability to apply Newtonian mechanics to model and predict the responses of simple dynamical system (particle and rigid body) subjected to applied forces.

More specifically, upon completion of this course students will be ability to:

- Explain and demonstrate the role that analysis and modeling play in engineering design and engineering applications more generally.
- Construct free-body diagrams and to calculate the reactions necessary to ensure static equilibrium.
- Perform analysis of distributed loads.
- Understand and calculate internal forces and moments in members.
- Calculate centroids and moments of inertia.
- Perform kinematic and kinetic analyses and energy and momentum methods for particles andsystems of particles.
- Perform kinematic and kinetic analyses and energy and momentum methods for rigid bodies.
- Communicate about systems using mathematical, verbal, and visual means, and
- Describe how engineering analysis fits into the larger framework of professional engineering.

Program Learning Outcomes

This course will help students attain the following learning outcomes required by theAccreditation Board for Engineering and Technology (ABET):

- an ability to identify, formulate, and solve complex engineering problems by applyingprinciples of engineering, science, and mathematics.
- an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- an ability to communicate effectively with a range of audiences.
- an ability to recognize ethical and professional responsibilities in engineering situations andmake informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- an ability to function effectively on a team whose members together provide leadership,create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- an ability to develop and conduct appropriate experimentation, analyze, and interpret data,and use engineering judgment to draw conclusions.
- an ability to acquire and apply new knowledge as needed, using appropriate learningstrategies.

Prerequisites

Introductory Physics (PHYS 8 or PHYS 18 or equivalent) and Calculus (MATH21 or equivalent)

Course

Readings will be assigned on a regular basis from the required textbook listed below and from

Requirements

class handouts (see schedule). These readings will be supplemented by class notes distributed at the lectures and available on the website. The following textbook is recommended and available for purchase at the campus bookstore:

Statics and Dynamics, 14th Edition, R.C. Hibbeler

Course Structure

Lectures. Prepare for each lecture by reading the assigned chapters and come to in-person/online class prepared to participate in discussion and in-class exercises. All class presentations will be posted on the CatCourses site.

If COVID outbreaks, we could be meeting online, students are required to attend class via Zoom. You must turn on your video and you can use background if you prefer if you are not comfortable to show original background.

Group Homework. There will be two group homework assignments, these assignments will be posted on CatCourses. Homework is due at the beginning of the class on the date indicated. Please, remember that academic integrity rules apply so you may work with other groups on your homework, but the product that you hand in should be the result of your own work. Late homework's will not be accepted.

Discussion/Case Studies. In discussion sessions, we will go over failure case studies to understand engineering design. You will be working with other team members. Please, remember that academic integrity rules apply so you may work with other groups to discuss, but the product that you hand in should be the result of your own group work.

Self-Learning Exercise. Self -learning exercises are do-it-all or nothing. No partial credits. Showing your work in professional way is important and work that is not numbered in order will not be considered as complete and will receive zero credit.

Quizzes. Each class module will have an online or in-class quiz with a time limit. Surprising quizzes are normal, so I urge you to attend class and study the discussed material. Quizzes can be either multiple choice, or fill-in-the-blank, or problem-solving questions.

Exams. There will be two exams. These exams could be a combination of multiple choice, fill-in-the-blank, and problem-solving questions.

Grading

The final grade will be the result of a weighted average of exams, homework, quizzes, in-classparticipation, and a class project as follows:

Exercise & Assessment	% of Grade	Remarks
Self – Learning Activity	7.5%	Do-It-All or Nothing
Quizzes	27.5%	
Discussion/Lab – Case Study	20%	
Group Homework	5%	
Exam -I	20%	
Exam-II	20%	

The final grade will be based on the following total point score for the class:

A	≥ 90%
B	80-89%
C	70-79%
D	60-69%
F	< 60%

Class Expectations and Policies

- Be on time. Attendance is mandatory.
- This course will be taught in-person at UC Merced. If COVID outbreaks, over Zoom. Please find a quiet place and silence your phones during zoom class or get on mute.
- No late assignments except in the case of a medical emergency. In such a case, a doctor's note ormedical release or other documentation **must** be provided. An assignment can be turned in as soon as it is available for submission in CatCourses.
- Exams may not be missed for any reason except for a medical emergency, in which case, adoctor's note or medical release **must** be provided.
- Instructors can be reached out via CatCourses messaging, email, or during office hours.
- The syllabus may change, so please be aware of announcements in CatCourses.

Academic Integrity

- Every student in this course is expected to abide by the University of California Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic creditwill be the student's own work.
- Plagiarism is a type of academic misconduct. Please review the U.C. Merced Library webpage tolearn more about what plagiarism is and how to avoid it. http://libguides.ucmerced.edu/citing_sources/citing-sources_avoiding-plagiarism
- The U.C. Merced Library link above also contains information on citations.
- Here is information on common types of plagiarism: https://www.bowdoin.edu/studentaffairs/academic-honesty/common-types.shtml
- References, also referred to as citations, are ways to document where you obtained content used in your work. This course will use the APA Style for references. You can locate more informationon how to create references using the APA format using the Purdue Owl (Online Writing Lab). https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_style_introduction.html
- You are encouraged to study together and to discuss information and concepts covered in lectureand the sections with other students. **Please make sure to follow the COVID-19 guidelines.** You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an email, an email attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.
- During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Anycollaborative behavior during the examinations will result in failure of the exam and may lead to failure

of the course and University disciplinary action.

Diversity and Equity

This class is conducted in accordance to the UC Merced Principles of Community[1], which include recognition and celebration of all identities, values and beliefs. Discrimination on thebasis of race, religion, sex, sexual orientation, gender identity, national origin, citizenship documented status, or any other social identity will not be tolerated. All class members including students, teaching assistants, observers and instructors are welcomed to discuss anysituation they perceive as harmful or threatening with the instructor in the class, during office hours or by appointment.

Accommodation of Students with Disabilities

The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design, and diversity. Siddaiah Yarra is available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.

ENGR 057 - TENTATIVE SCHEDULE

	Day, Date	Time		Topic	Reading from Textbook	Open Educational Resources (OER)
Week #						https://mathalino.com/reviewer/engineering-mechanics/engineering-mechanics
1	Thursday, August 26, 2021	10:30 am -11:45 am	Lecture	Statics - Introduction, Units of measurements, Introduction to Vectors, and Force System	Ch 1 through 5	Principles of Statics, Equilibrium of Force System
2	Tuesday, August 31, 2021	10:30 am -11:45 am	Lecture	Statics - Introduction, Units of measurements, Introduction to Vectors, and Force System		
2	Thursday, September 2, 2021	10:30 am -11:45 am	Lecture	Statics - Introduction, Units of measurements, Introduction to Vectors, and Force System		
3	Tuesday, September 7, 2021	10:30 am -11:45 am	Lecture	Statics - Analysis of Structures - Trusses & Beams	Ch 6 & Ch 7	Analysis of Structures
3	Thursday, September 9, 2021	10:30 am -11:45 am	Lecture	Statics - Analysis of Structures - Trusses & Beams		
4	Tuesday, September 14, 2021	10:30 am -11:45 am	Lecture	Statics - Analysis of Structures - Trusses & Beams		
4	Thursday, September 16, 2021	10:30 am -11:45 am	Lecture	Statics - Analysis of Structures - Trusses & Beams		
5	Tuesday, September 21, 2021	10:30 am -11:45 am	Lecture	Statics - Center of Gravity, Centroids, and Moments of Inertia	Ch 9 & Ch 10	Center of Gravity, Centroids, and Moments of Inertia
5	Thursday, September 23, 2021	10:30 am -11:45 am	Lecture	Statics - Center of Gravity, Centroids, and Moments of Inertia		
6	Tuesday, September 28, 2021	10:30 am -11:45 am	Lecture	Statics - Center of Gravity, Centroids, and Moments of Inertia		
6	Thursday, September 30, 2021	10:30 am -11:45 am	Lecture	Statics - Friction		
7	Tuesday, October 5, 2021	10:30 am -11:45 am	Lecture	Statics - Friction		
7	Thursday, October 7, 2021	10:30 am -11:45 am	Lecture	**Exam - I**		
8	Tuesday, October 12, 2021	10:30 am -11:45 am	Lecture	Dynamics - Particle Kinematics	Ch 12 & Ch 16	Dynamics
8	Thursday, October 14, 2021	10:30 am -11:45 am	Lecture	Dynamics - Particle Kinematics		
9	Tuesday, October 19, 2021	10:30 am -11:45 am	Lecture	Dynamics - Particle Kinematics		
9	**Thursday, October 21, 2021**	10:30 am -11:45 am	Lecture	Dynamics - Particle Kinematics		
10	Tuesday, October 26, 2021	10:30 am -11:45 am	Lecture			
10	Thursday, October 28, 2021	10:30 am -11:45 am	Lecture	Dynamics -Particle Kinetics	Ch 13 through Ch 15	
11	Tuesday, November 2, 2021	10:30 am -11:45 am	Lecture	Dynamics -Particle Kinetics		
11	Thursday, November 4, 2021	10:30 am -11:45 am	Lecture	Dynamics -Particle Kinetics		
12	Tuesday, November 9, 2021	10:30 am -11:45 am	Lecture	Dynamics -Particle Kinetics		
12	Thursday, November 11, 2021	10:30 am -11:45 am	**Veterans Day Holiday**			
13	Tuesday, November 16, 2021	10:30 am -11:45 am	Lecture	Dynamics - Rigid Body Planar Kinematics	Ch 16	
13	Thursday, November 18, 2021	10:30 am -11:45 am	Lecture	Dynamics - Rigid Body Planar Kinematics		
14	Tuesday, November 23, 2021	10:30 am -11:45 am	Lecture	Dynamics - Rigid Body Planar Kinematics		
14	Thursday, November 25, 2021	10:30 am -11:45 am	**Thanksgiving Holiday**			
15	Tuesday, November 30, 2021	10:30 am -11:45 am	Lecture	Dynamics - Rigid Body Planar Kinetics	Ch 17 through Ch 19	
15	Thursday, December 2, 2021	10:30 am -11:45 am	Lecture	Dynamics - Rigid Body Planar Kinetics		
16	Tuesday, December 7, 2021	10:30 am -11:45 am	Lecture	Dynamics - Rigid Body Planar Kinetics		
16	Thursday, December 9, 2021	10:30 am -11:45 am	Lecture	**Exam - II**		
	Saturday, December 11, 2021	**3:00 pm - 6:00 pm**		**Final Exam Day**		