

## ENGR 200 Engineering Mechanics - Statics, Cuyamaca College

Fall Semester 2009, Section 1236

Monday, Wednesday 6:00 - 7:25 pm, Room F301

*Engineering Mechanics* is the study of how objects behave when subjected to forces. *Statics* is the first course in the Engineering Mechanics sequence at Cuyamaca College. Statics is the study of objects in force equilibrium, objects such as bridges, dams, and buildings. Engineers consider Statics to be the most fundamental of all engineering courses: the concepts developed in this course will be useful throughout your engineering career. In particular, Statics is the prerequisite class for Dynamics, the study of forces in moving (dynamic) objects like engines and vehicles. Thus Statics provides basic knowledge needed for both structural design and machine design. Students who complete the course will be able to 1) determine forces and moments applied to static rigid bodies, 2) reduce a set of applied forces and moments to a simple force-couple system, 3) determine the forces throughout a truss structure based on either distributed or locally applied loads, 4) determine the center of gravity and the moment of inertia of an object.

### Professor

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Cuyamaca College Engineering Website: [www.cuyamaca.edu/engr](http://www.cuyamaca.edu/engr)

Office Hours: MW 5 - 6 pm, T 6 - 7 pm, W 2 - 3 pm, Th 12 - 1 pm, or by appointment

### Text

*Engineering Mechanics: Statics, 11<sup>th</sup> Edition*, R. C. Hibbeler.

### Units and Prerequisites

3 units, Prerequisite: PHYC 190, Corequisite: MATH 280.

### Grading

A: 90 - 100

B: 80 - 89.9999

C: 70 - 79.9999

D: 60 - 69.9999

F: < 60

Homework	15%
Quizzes	60%
Final Exam	20%
Participation	5%

### Notes on grades:

- 1) There will be a 20-minute quiz each Monday as shown in the schedule.
- 2) There will be no make-up quizzes. However your lowest 3 quiz grades will be dropped. Neither the homework nor the final exam can be dropped.
- 3) Homework assigned at one class meeting will be due the following class meeting.
- 4) Homework grading will be based purely on whether it is submitted on time. Before you get too complacent about this, recognize that the homework is where you'll be doing most of your learning. If you don't put a lot of effort into it, you won't do well on the quizzes and exams, and you won't pass the class. Solutions will be available in the library on the day the homework is due, but again, unless you bust your butt trying to do the homework yourself, you probably won't succeed in the class. If you try and try and still can't figure out a problem (this happens) then please come see me during office hours. Don't email me with questions about homework: statics usually requires sketches and interaction that don't translate easily to email.
- 5) All quiz and exam problems will be graded according to the grading rubric on the last page of the syllabus.
- 6) Participation will be measured by response to in-class questions. These will be answered using a computerized "audience response system." Note: you do not have to get the answers right, but you do have to formulate an answer to get participation points.

### Policies

- 1) Always read the material to be covered in class *before* the lecture.
- 2) Always bring textbook and calculator to class
- 3) Late homework will not be accepted.
- 4) Cheating. If I think you are cheating on a quiz:
  - a) You will get a zero for that quiz
  - b) I will invite you to withdraw from the class
- 5) Cell phones must be off before lecture begins. This includes text messages transmitted or received.

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### Course Objectives (Expected Student Learning Outcomes)

Students will be able to:

- 1) Apply principles of vector algebra to determine the resultant of several concurrent forces acting on a particle in both 2D and 3D space.
- 2) Apply the principle of particle equilibrium and 1) above to determine unknown forces acting on a static particle.
- 3) Apply cross- and dot-products of vectors to determine the moment of a force about a) a point in space and b) an axis in space.
- 4) Simplify a system of forces and couples applied to a rigid body into a single resultant force and couple.
- 5) Apply the principle of rigid body equilibrium and 4) above to determine unknown forces and moments acting on a static rigid body. Determine reactions at supports for 2-D and 3-D rigid bodies, recognizing if these reactions are statically determinate or indeterminate.
- 6) Perform basic structural analysis of trusses using the methods of joints and sections. Perform basic structural analysis of frames and machines.
- 7) Calculate the internal forces within beams subjected to various types of loading and supports and draw shear and bending moment diagrams.
- 8) Apply the basic concepts of dry friction to analyze wedges, square-threaded screws, belt and rolling friction.
- 9) Determine centroids and centers of gravity of mathematically definable areas and bodies as well as composite areas and bodies made of standard geometric shapes.
- 10) Determine the area- and mass-moments of inertia and the radii of gyration of mathematically definable areas and bodies, as well as composite areas and bodies made of standard geometric shapes.
- 11) In general, model real-life mechanically static situations both graphically and mathematically, applying simplifying assumptions as needed while estimating the effects those assumptions have on the solution. Also identify those situations that cannot be modeled using particles or rigid bodies.

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*Tentative schedule*

Week	Date	Topic	Reading	Quiz
1	31 Aug - 2 Sep	Forces in 2 dimensions	Ch 1, 2.1 - 2.4	
2	7 Sep - 9 Sep	<b>Labor Day (no class) on 7 Sept</b> Forces in 3 dimensions	Ch 2.5 – 2.6	1
3	14 Sep – 16 Sep	Position vectors, forces along a line, dot products	Ch 2.7-2.9	2
4	21 Sep – 23 Sep	Particle equilibrium	Ch 3	3
5	28 Sep – 30 Sep	Moment of a force	4.1-4.5	4
6	5 Oct – 7 Oct	Couples, equivalent force-couple systems	4.6 – 4.9	5
7	12 Oct - 14 Oct	Reduction of a distributed load Introduction to rigid body equilibrium	4.10 5.1 – 5.2	6
8	19 Oct – 21 Oct	Rigid body equilibrium	5.3-5.7	7
9	26 Oct – 28 Oct	Structural analysis: Trusses	6.1-6.5	8
10	2 Nov - 4 Nov	Frames and machines, Internal forces	6.6, 7.1	9
11	9 Nov - 11 Nov	Dry friction, wedges and screws	8.1 – 8.4	10
12	16 Nov – 18 Nov	Centroids	9.3, 9.1-9.2	11
13	23 Nov – 25 Nov	Applications of Centroids Intro to moments of inertia	9.4 – 9.6, 10.1, 10.9	12
14	30 Nov, 2 Dec	Moments of inertia	10.5, 10.2-10.4	13
15	7 Dec - 9 Dec	Misc. topics: Internal forces, cables, belt friction, bearing and rolling friction	7.2 – 7.4, 8.5 – 8.8	14
	14-Dec	<b>Final Exam</b> (6 – 8 pm)		

**Important Dates**

4 September: Last day to drop without a 'W'  
 12 November: Last day to drop classes.

This course adheres to policies outlined in the Cuyamaca College Catalog. For further information, please see the section of the catalog entitled *Academic Policies*.

*subject to minor changes*

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**ENGR 200 Universal Grading Rubric for Quiz and Exam Problems**

**Level 5, Exemplary. 100%** Gives a complete response with a clear, coherent, unambiguous and elegant explanation; includes a clear and simplified diagram when appropriate; shows deep understanding of the problem's important ideas and processes for solution; no math errors.

**Level 4, Competent. 87%** Gives a fairly complete response with reasonably clear explanations; includes a diagram when appropriate; shows understanding of the problem's important ideas and processes for solution; 1 or 2 minor computational errors.

**Level 3, Flawed, but acceptable. 73%** Completes the problem, but the explanation may be muddled; diagram may be inappropriate or unclear; understands the main ideas and processes for solution, 3 minor computational errors, one big computational error, or one minor conceptual misunderstanding.

**Level 2, More seriously flawed, but nearly acceptable. 60%** Begins the problem appropriately but may omit significant parts of the problem; may fail to show full understanding of problem's important ideas and processes for solution (several minor conceptual errors or one major one), may make many minor computational errors or one major computational errors; response may reflect an inappropriate strategy for solving the problem.

**Level 1, Very seriously flawed, unacceptable. 30%** Explanation is not understandable; diagram may be unclear; shows little understanding of the problem situation; may make major computational errors or several major conceptual errors. Possibly starts, but fails to complete much of the problem.

**Level 0, Unable to begin effectively. 0%** Words do not reflect the problem; drawings misrepresent the problem situation; copies parts of the problem but without attempting a solution; fails to indicate which information is appropriate to the problem.

**Finally**, any answer lacking the appropriate units will earn *no better than* Level 1.

**Advice on homework problems**

1. Always do the example problems in the homework section you're working on. The examples hold clues to the reasoning needed to solve the homework.
2. The first steps in solving any problem are 1) to sketch the problem, and 2) state what it is you're solving for. There are several reasons for this:
  - a) It helps you define the problem in your own mind, and lays the groundwork for the solution.
  - b) I won't help you with a homework problem unless you've done this.
3. Engineering problems often must be left to fester in your mind. You may not see the solution right away, whereas if you come back to the problem the next day, it may be more obvious. *Moral of the story:* don't wait until the last day to try the homework problems.
4. Plan on a *minimum* of 1 hour per homework problem. It really does take time to wrap your brain around these problems. It's worth the time: you will do 95% of your learning in this class doing the homework
5. Work on the homework problems alone, then get together with a study group. Make sure everyone in your study group understands the problems and the solutions *before* the quiz. Helping other people understand is not only good karma, it improves your mastery of the topic.