ME 40: Thermodynamics

2019 Summer Session B: June 10 – August 16

Classes

Lecture
Tu, Th 3:10 - 5:30 pm in 107 Genetics and Plant Biology

Discussion
W 3:40 - 5 pm in 310 Hearst Memorial Mining

Instructor

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Office Hours: M 2 - 3 pm & F by appointment in Etcheverry Hall, Tien Room

Teaching Staff

Emma McClure, MS

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Office Hours: W & Th 2 - 3 pm in Hesse "fishbowl"

Communications

Websites
https://bcourses.berkeley.edu/courses/1482283

https://piazza.com/berkeley/summer2019/me40/home

We will do our best to monitor questions on Piazza and will prioritize this over email. As it's intended to be a collaborative learning platform, we expect that students will take the time to respond to each other before we contribute.

Description

ME 40: Thermodynamics (3 units). 10 weeks - 4.5 hours of lecture + 1.5 hours of discussion per week. *Estimated* homework/study time - 7.5 hours per week.

Prerequisites: Chemistry 1A, Engineering 7, Mathematics 1B, and Physics 7B

This course introduces the scientific principles that deal with energy conversion among different forms, such as heat, work, internal, electrical, and chemical energy. The physical science of heat and temperature, and their relations to energy and work, are analyzed on the basis of the four fundamental thermodynamic laws (zeroth, first, second, and third). These principles are applied to various practical systems, including heat engines, refrigeration cycles, air conditioning, and chemical reacting systems.

Course Objectives

The objectives of this course are:

1. to provide the fundamental background of thermodynamics principles.
2. to develop analytic ability in real-world engineering applications.

Specific student learning outcomes are:

1. an ability to apply knowledge of math, science, and engineering.
2. an ability to identify, formulate, and solve engineering problems.
3. an understanding of professional and ethical responsibility.
4. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
5. a recognition of the need for, and ability to engage in life-long learning.
6. a knowledge of contemporary issues.
7. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Textbooks

Required
Çengel & Boles, *Thermodynamics: An Engineering Approach*, 9th Edition. Other recent editions may be acceptable (e.g. 6th - 8th), but it is your responsibility to ensure that the course readings and class examples match up.

Supplemental
Moran & Shapiro, *Fundamentals of Engineering Thermodynamics*.

Wark & Richards, *Thermodynamics*.

Potter & Somerton, *Thermodynamics for Engineers*, Schaum's outlines.

Programming

You may occasionally be asked to write simple programs for homework assignments using MATLAB®. If access is an issue, please let us know.

Grading

- Homework Assignments – 30%
- 2 Midterm Tests – 35%
- 1 Final Exam – 35%

Attendance

Consistent attendance is expected, but not required. If you are absent, please request notes from a classmate. You are responsible for all material covered.

Homework

Homework will be assigned weekly and due the following Tuesday at 3:10 pm in the front of the lecture classroom. No late homework will be accepted.

We will grade an unannounced *subset* of the problems each week, though solutions for all problems will be posted on bCourses. Please review solutions. Your lowest homework assignment score will be dropped for your final grade.

Exams

Exams will take place in the regular classroom during the first hour of select Tuesday lectures. As this is an accelerated 10-week summer class, we will take a 30-minute break and resume teaching content for the last hour of class.

Tests will be closed book/notes/internet/phone, though you will be allowed a sheet (8.5" x 11", double-sided) of your own notes *cumulatively* for each exam (i.e. 1 page for the 1st midterm, 2 for the 2nd midterm, and 3 for the final exam).

Missing an exam will result in a zero grade for that exam unless alternative arrangements are made with the instructor *prior* to the exam. Exceptions may be made for severe medical or family emergencies.

Regrades

Any serious concerns about grading should be addressed to the instructor (not the GSI) *within 7 days* of receiving the graded homework or exam back. Include *a brief, written explanation* of your concern. Re-graded scores may go up, down, or stay the same. I reserve the right to re-grade the other problems on the homework or exam as well. Other minor concerns about grading should be addressed to the GSI.

Collaboration vs Academic Misconduct

Collaboration and discussion on the homework is encouraged in this class, but assignments turned in for a grade must be a student's own work. Consulting with your colleagues is fine, but *copying from somebody else's homework solution is considered academic misconduct*.

We strongly recommend that you first attempt every homework problem on your own, and only *then* meet with your colleagues to check and improve your work. The best learning usually comes after getting stuck on your own.

"Academic misconduct is any action or attempted action that may result in creating an unfair academic advantage for oneself or an unfair academic advantage or disadvantage for any other member or members of the academic community." (Definition from UC Berkeley Center for Student Conduct).

Academic misconduct will be referred to the Student Conduct Office.

Diversity Statement

I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

Course Outline

Week	*Tuesday*	*Thursday*	*Reading*
1	Introduction, Definitions, & Basic Concepts	1st Law of Thermo (Energy Conservation)	ÇB 1-2
2	Properties & States of Pure Substances ***ps1 due***	Closed System Analysis (Control Mass)	ÇB 3-4
3	Open System Analysis (Control Volume) ***ps2 due***	Un/steady Open System Analysis	ÇB 5
4	**MIDTERM 1**	***Academic Holiday***	ÇB 6 Wark 6-6
5	2nd Law of Thermo (Entropy Change) ***ps3 due***	Ir/reversible Processes, *T ds* Relations, & Isentropic Efficiency	ÇB 7
6	Property Tables & Approximations ***ps4 due***	Gas Power Cycles	ÇB 9
7	**MIDTERM 2**	Vapor & Combined Power Cycles	ÇB 10
8	Cycle Improvements & Refrigeration Intro ***ps5 due***	Refrigeration Cycles	ÇB 11
9	Behavior & Properties of Gas Mixtures ***ps6 due***	Guest Lecture on Combustion	ÇB 13
10	Final Review of Course Content ***ps7 due***	**FINAL EXAM** 1 - 4 pm OR 3 - 6 pm	