

## MECH 2010: Thermodynamics

Fall 2022, 4 credits

University of Cincinnati

<b>Class Meeting</b>	TuTh 12:00 – 01:50 pm Zimmer 413
<b>Instructor</b>	Dr. Kishan Bellur <a href="mailto:bellurkn@ucmail.uc.edu">bellurkn@ucmail.uc.edu</a>
<b>Office Hours</b>	TuTh 2:00 pm – 3:00 pm or by appointment Rhodes 681A
<b>Textbook</b>	<i>Fundamentals of Engineering Thermodynamics</i> , 9th Edition, by Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, Margaret B. Bailey.  Any older/international edition will work just fine. An ebook version is also available.

### Course Learning Outcomes

In this course, you will:

- 1) learn about mass and energy balances for closed and open systems,
- 2) develop an understanding of entropy, the second law of thermodynamics, and isentropic efficiencies of engineering devices,
- 3) be able to use these concepts to analyze power and refrigeration cycles, and
- 4) be able to apply principles of thermodynamics to formulate and solve engineering problems of interest.

### Correspondence

Messages about the class will be sent through Canvas or via email. However, if you have any questions or concerns, please contact me via *email* only. Please add a prefix to the subject line: “**MECH2010: <short title>**”. This helps me find the email faster and respond in a timely manner. If I do not respond within 24 hours, please send a follow-up email. Alternatively, you can also use the discussion forum on Canvas to ask questions. The forum is open to the entire class so that your classmates can help answer and/or benefit from your question.

### Grading

*Overall grade*

A:	≥ 93%,
A-:	90% – 93%
B+:	87% – 90%
B:	83% – 87%
B-:	80% – 83%
C+:	77% – 80%
C:	73% – 77%
C-:	70% – 73%
D+:	67% – 70%
D:	63% – 67%
F:	≤ 63%
I:	Incomplete

*Assessment and weighting*

Participation / Engineering Practice	10%
Quiz	10%
HW Assignments	10%
Exam 1	20%
Exam 2	20%
Final	30%

**Tentative Schedule** (subject to minor variations)

Module	Weeks	Topics	Book Chapter	Comments
1	1-4	Basic Concepts	1	
		First Law of Thermodynamics for Closed Systems	2	
		Evaluating Thermodynamic Properties	3	
2	5-6	First Law of Thermodynamics for Control Volume	4	Exam 1
3	7-10	Second Law of Thermodynamics	5	
		Entropy	6	
4	11-12	Vapor Power Systems	8	Exam 2
5	13-14	Gas Power Systems	9	Tour of UC Power Plant
6	15	Refrigeration and Heat Pump Systems	10	
	16	Review		FINAL

**Attendance / Participation**

You are expected to attend all classes. More important than simply attending, however, is being present for the active process of learning that occurs in class. You will be placed into groups for problem solving activities and presentations. Participation in class discussions and group activities is expected and will count towards your overall grade. You are responsible for the material covered during lecture, assigned readings, homework and quizzes. Announcements concerning changes to homework assignments and other deadlines will be given during lecture or via Canvas. You are responsible for keeping up-to-date with the course. Please turn off or silence your cell phones during the class period.

**Engineering Practice**

A part of your grade is devoted to an “engineering practice” project. A part of being an engineer is learning to work as a group, researching new areas and then communicating results to a non-technical audience. In this course, you will have the opportunity to practice this component of engineering. A list of open-ended design problems is posted on canvas. You will work together as a group to address the problem and then present your results to the whole class. There is no single correct answer to these problems. You are free to take any direction you think is appropriate. Presentations will be scheduled weekly. As a group, pick a topic and a time slot. Send me an email (cc all group members) with your choice and I will confirm/update the schedule on canvas. All topics/time slots are first come first served. Once a group has picked a topic and time slot, it is no longer available for the other groups. The longer you wait, the narrower your options become.

### **Homework Assignments**

Assignments are an important aspect of the course that develops your critical thinking, math and problem-solving skills. All problems are assigned a score between 0 and 3 (0 – no attempt, 1 – attempt with clearly incorrect solution, 2 – attempt with partially correct solution, and 3 – attempt with fully correct solution). The emphasis is not on the final numerical answer but rather the method/approach. Solutions to the homework assignments will be discussed in class or posted to Canvas. All homework must be prepared in a straightforward and professional manner. Late submission will result in a grade reduction of 20% per day. You are welcome to discuss the contents of an assignment with others, but you must submit an individual solution and you must acknowledge any/all help received during the discussion.

### **Exams**

There will be two exams and a final. Exams and quizzes will be closed book. During the exams, you will be allowed a single sided letter sized (8.5" x 11") formula sheet of your own creation. You will be required to submit the formula sheet along with the exam. No makeup exams will be given without prior approval. If an absence is unavoidable, arrangements must be made with the instructor for an oral exam *prior to the date of the absence*. Missing an exam due to documented illness or emergency will be handled on a case-by-case basis.

### **Quizzes**

There will be several in-class quizzes during lectures throughout the term. The quizzes will be used as a tool to test conceptual understanding rather than mathematical rigor. No makeup quizzes will be given. Missing a quiz due to a documented illness or emergency will be handled on a case-by-case basis with oral examinations.

### **Academic Integrity**

I have a zero-tolerance policy with regard to cheating. "Intentional, unauthorized use of any study aids, equipment, or another's work on an academic exercise" is cheating. "Knowingly allowing or helping another individual to plagiarize, cheat or fabricate information" also falls under academic dishonesty and will be treated the same as cheating. Using the internet (email, www, listservs, usenet, blogs, wiki's, etc.) or social media to *gather information* on topics related to homework and projects is permissible. However, do not solicit *solutions* to homework problems from the internet. Academic dishonesty is a serious violation of University Policy and will be dealt with accordingly. Cheating on an assignment, project or exam will result in a grade of zero and trigger an investigation. Any questions regarding permissible collaborations or information sources should be brought to the instructor for clarification.

## **Accessibility**

UC is committed to providing all students full and equal access to learning opportunities. [UC's Office of Accessibility Resources](#) is the official campus office that works to arrange for reasonable accommodations for students with an identified physical, psychological, or cognitive disability (learning, ADD/ADHD, psychological, visual, hearing, physical, cognitive, medical condition, etc.). Students are encouraged to contact the Accessibility Resources office to arrange for a confidential meeting to discuss services and accommodations. Contact should be initiated as soon as possible to allow for adequate time for accommodations to be arranged.

UC is also committed to providing full and equal access to our electronic and information technology, including websites, electronic files, digital course content, and software/applications. If you experience difficulty in using any of the digital content associated with this course, even with the assistance of available [Student Accessibility Resources](#), please let your instructor know.

## **Title IX**

Title IX is a federal civil rights law that prohibits discrimination on the basis of a person's actual or perceived sex, gender, gender identity, gender expression, or sexual orientation. Title IX also address instances of sexual violence, dating or domestic violence, and stalking. If a student discloses a Title IX issue to a faculty member, the faculty member is required to forward that information to the [Title IX Office](#). The Title IX office will follow up with the student and discuss how the University can take steps to address the impact on the student and the community. They will also inform the student of their rights and direct them to available resources. The priority is to make sure students are safe and successful here at the University of Cincinnati. Students are not required to talk to anyone in the Title IX Office. Students may also directly report any instance of sex or gender-based discrimination, harassment or violence to the Title IX office at 513-556-3349. Students who wish to know more about their rights and resources on campus, they can consult the [Title IX website](#) or contact the Title IX office directly at 513-556-3349.

## **Counseling Services**

Students have access to counseling and mental health care through the [University Health Services](#), which can provide both psychotherapy and psychiatric services. UC's [Counseling & Psychological Services](#) (CAPS) provides students access to professional counseling services as well as numerous options for help online, via mobile apps, group sessions, and peer-to-peer programs. CAPS conducts free virtual consultations via the "Let's Talk" program. Students are encouraged to seek assistance for anxiety, depression, trauma/assault, adjustment to college life, interpersonal/relational difficulty, sexuality, family conflict, grief and loss, disordered eating and body image, alcohol and substance abuse, anger management, identity development and issues related to diversity, concerns associated with sexual orientation and spirituality concerns, as well as any other issues of concern.

## **Inclusivity**

This class is committed to the fundamental principles of academic freedom and human dignity. Diversity in all forms is something we welcome, we foster, and we prize. We believe that honest attempts to understand the perspectives of others facilitates learning, and we will strive to achieve this goal at all times. We strongly disavow discrimination -- including harassment -- on the basis of race, national or ethnic origin, religion, sex or gender identity, disability, age, sexual orientation, or veteran status. We expect that each of us will hold one another accountable for maintaining these ideals.

All are welcome and considered a valuable addition to the university community. You should consider my classroom as an inclusive and safe space to express your ideas and viewpoints. No discrimination is accepted or tolerated in this course.