

ME 2232 - Engineering Thermodynamics

Credits and Contact Hours: 4 Credits. Three 50-minute or two 75-minute lectures per week and a 50-minute discussion/lecture/problem solving session.

Instructors: Ugur Pasaogullari, Reza Sheikhi, Thanh Nguyen, Chih-Jen Sung, David Giblin, Wajid Chishty, Mihai Duduta, SeungYeon Kang

Textbook: *Fundamentals of Engineering Thermodynamics, 9th edition, by M.J. Moran, H.N. Shapiro, D.D. Boettner, and M.B. Bailey, John Wiley & Sons, 2018.*

Specific Course Information:

a. Catalog Description: Energy Literacy. First and Second Laws of Thermodynamics. Thermodynamic properties and property relations of pure substances, ideal gases, and ideal gas mixtures. Analysis of ideal and real processes. Thermodynamic cycles. Energy efficiency. This course aims to provide the students with the fundamental understanding of laws of thermodynamics and how they can be applied to maximize the performance of thermodynamic devices. Concepts of net energy flow to the systems, in the form of heat transfer and work are discussed. In addition, energy and entropy rate balance equations are developed and applied to closed and open systems.

b. Prerequisites: CHEM 1127Q or both CHEM 1124Q and CHEM 1125Q; PHYS 1230 or PHYS 1401Q or PHYS 1501Q or PHYS 1601Q; MATH 2110Q, which may be taken concurrently.

Corequisites: MATH 2110Q

Course Restriction: May not be taken for credit after passing ME 2233 or ME 2234

c. Required, Elective, or Selected Elective: Required

Specific Goals:

a. Course Learning Objectives and Outcomes:

After completing ME 2232 students should be able to:

1. Implement the governing laws and principles to design and improve efficiency of thermodynamic devices and systems.
2. Determine the thermodynamic state of a system.
3. Analyze thermodynamic systems.
4. Develop energy solutions to promote efficient use of energy and environmental sustainability.

b. Relationship of Course Outcomes to Criterion 3 Student Outcomes:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

Students acquire the ability to utilize the laws of thermodynamics along with mathematical tools to analyze and solve complex engineering problems. Students learn to identify, formulate and solve basic engineering problems through assignments that involve the analysis of real thermal systems. Students are expected to identify the thermodynamic principles involved and to implement them to engineering interest.

2. 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
Students begin to acquire the ability to design thermal systems, components, and processes to meet a desired need with consideration of optimal energy usage and environmental impacts
3. an ability to communicate effectively with a range of audiences
Students gain the ability to write effectively through the Design Project work.
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
Students begin to analyze the environmental impact of thermal system design choices and the importance of efficient energy utilization on the environment and economy.
5. 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
Students gain team experience working in small groups for the Design Project.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
Students gain the ability to analyze and interpret data and use the data to draw engineering conclusions through the Design Project work.
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
The class provides students with the recognition that subsequent courses and material will build upon the fundamental principles presented. Students are required to perform research for their Design Project work with material outside that presented in class.

Topics Covered:

1. Energy and energy transfer through work and heat transfer.
2. Governing laws in engineering thermodynamics.

3. Characterizing the state of a system through its properties.
4. Analyzing open and closed thermodynamic systems.
5. Concept of useful work.
6. Working principles of thermodynamic cycles and devices.
7. Analyzing energy conversion and efficiency of power production, propulsion, refrigeration as well as heating and cooling systems.
8. Ideal and actual (real) systems. Limitations and constraints imposed on actual systems by the governing thermodynamics laws.
9. Analysis of integrated systems (such as cogeneration, combined and integrated cycles) for higher efficiency, energy conservation, energy waste reduction and environmental sustainability.

Course Requirement and Grading:

Course Components	Weight
Homework and Quizzes	25%
Midterm Exam(s)	25%
Final Exam	25%
Design Project	25%

Homework

Homework and quizzes will be assigned for the course topics covered. These include conceptual questions and thermodynamic problems to be solved. These activities also include questions to highlight the professional responsibility of engineers related to efficiency and environmental factors associated with energy usage in thermodynamic systems.

Midterm and Final Exam

The midterm and final exams will cover the topics covered in the course.

Design Project

The design project involves tackling an open-ended problem, which requires the analysis and/or design of a thermodynamic cycle to meet specified constraints concerning performance, energy waste reduction, energy efficiency and environmental impacts.

Grading Scale:

Grade	Letter Grade
Excellent	A
	A-
Very Good	B+

Good	B
	B-
	C+
Average	C
Fair	C-
Poor	D+
	D
Merely Passing	D-
Failure	F

Student Responsibilities and Resources

As a member of the University of Connecticut student community, you are held to certain standards and academic policies. In addition, there are numerous resources available to help you succeed in your academic work. Review these important [standards, policies and resources](#), which include:

- The Student Code
 - Academic Integrity
 - Resources on Avoiding Cheating and Plagiarism
- Copyrighted Materials
- Netiquette and Communication
- Adding or Dropping a Course
- Academic Calendar
- Policy Against Discrimination, Harassment and Inappropriate Romantic Relationships
- Sexual Assault Reporting Policy

Students with Disabilities

The University of Connecticut is committed to protecting the rights of individuals with disabilities and assuring that the learning environment is accessible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, please let me know immediately so that we can discuss options. Students who require accommodations should contact the Center for Students with Disabilities, Wilbur Cross Building Room 204, (860) 486-2020 or <http://csd.uconn.edu/>.

Software/Technical Requirements (with Accessibility and Privacy Information)

The software/technical requirements for this course include:

- HuskyCT/Blackboard ([HuskyCT/ Blackboard Accessibility Statement](#), [HuskyCT/ Blackboard Privacy Policy](#))

- [Adobe Acrobat Reader](#) ([Adobe Reader Accessibility Statement](#), [Adobe Reader Privacy Policy](#))
- [Google Apps](#) ([Google Apps @ UConn Accessibility](#), [Google for Education Privacy Policy](#))
- [Microsoft Office](#) (free to UConn students through uconn.onthehub.com) ([Microsoft Accessibility Statement](#), [Microsoft Privacy Statement](#))