



ME2233-010

Thermodynamic Principles

Summer 2025

Format and Time: All instructions occur online with remote asynchronous.
Course Duration: **June 2, 2025, to July 3, 2025**

Instructor: Dr. Wajid Ali Chishty

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Office Hours: Thursdays 6:00 PM to 8:00 PM, via Microsoft Teams (link: [Click here to join the meeting](#))

Course Description: Introduction to the First and Second Laws of Thermodynamics. Thermodynamic properties of pure substances and ideal gases. Analysis of ideal and real processes, cycles and machines like turbines, pumps, heat exchangers, and compressors.

This course is the first undergraduate level course in Thermodynamics, with an aim to prepare a foundation for advanced courses in thermal-fluid sciences.

Prerequisites: CHEM 1127Q or both CHEM 1124Q and CHEM 1125Q; PHYS 1401Q or PHYS 1501Q; MATH 2110Q, which may be taken concurrently. May not be taken out of sequence after passing ME 3232, 3242, or 3250.

Course Objectives: Upon completion of this course, students will be able to:

- Understand and implement the principles of mass and energy conservation on various engineering systems.
- Determine and identify a thermodynamic property, state, process, and system.
- Understand and explain thermodynamic equilibrium and the state principle.
- Compute and analyze interactions between a system and its surroundings.
- Understand and apply equations of state and explain the limitations.
- Understand and analyze thermodynamic cycles and determine their efficiency and limits.

HuskyCT Location: https://huskyct.uconn.edu/ultra/courses/_175091_1/outline

Textbook: Moran, Shapiro, Boettner and Bailey, **Fundamentals of Engineering Thermodynamics**, 9th edition, Wiley



Husky Book Bundle Digital Access:

This course is part of our course material delivery program, Husky Book Bundle. The bookstore will provide each student with a convenient package containing all required physical materials and all digitally delivered materials for this course will be integrated into Blackboard. You should have received an email from the bookstore confirming materials provided for each of your courses and asking you to select how you would like to receive any printed components (in-store pick up or home delivery). If you have not done so already, please confirm your fulfillment preference so the bookstore can prepare your materials.

For more information about Husky Book Bundle, or for the link to opt-out of this program, please go to:

<https://bookbundle.program.uconn.edu/>

Course Format Details:

This course will be conducted in an **Asynchronous Online** format.

Grading:

Mid-Term Exam (25%), Final Exam (25%), Homework Assignments (25%), Quizzes (25%)

Percent Points (\geq)	Letter Grade	GPA
92.5	A	4.0
89.5	A-	3.7
86.5	B+	3.3
82.5	B	3.0
79.5	B-	2.7
76.5	C+	2.3
72.5	C	2.0
69.5	C-	1.7
66.5	D+	1.3
62.5	D	1.0
60	D-	0.7
< 60	F	0.0

Scores for the individual grading components will be posted on HuskyCT as soon as they are ready. However, the cumulative percentage and the letter grade indicated on HuskyCT should not be construed as the final percentage points or the final grade.



Learning Material: Lecture notes for the week will be posted on HuskyCT at the start of the week. Additional lecture recordings will be uploaded on HuskyCT as and when needed during the week. You are encouraged to complete the reading assignments specified at the end of each lecture notes.

Exams: Two exams will be administered: one mid-term and one final. The final exam is not a comprehensive exam but would rather consist of the topics covered after the mid-term exam. However, knowledge of previous topics is necessary to successfully write the final exam.

All exams will be open books and open class lecture notes. No other help is allowed. Calculators are allowed but no software aid is allowed, unless otherwise and explicitly instructed.

Exams will be asynchronous. These exams will be posted on HuskyCT for you to download and must be submitted by uploading on the HuskyCT. Please note the dates and times for these exams on the weekly schedule/breakdown table at the end of this document.

Grading will be done based on calculations/details/results shown on the exam sheets. No credit will be given for showing the answers only. **Submit ONE document in PDF format. Multiple files will not be accepted.** It is your responsibility to ensure that your uploads are correct and complete. Late submissions will not be accepted. No makeup exam requests will be entertained.

Homework Assignments:

There will be five homework assignments, due every Friday before 5:00 PM. These assignments will be posted on HuskyCT for you to download. Homework must be submitted by uploading on HuskyCT. **Submit ONE document in PDF format. Multiple files will not be accepted.** Group consultation is encouraged but the submissions should be individual and original work. Late submissions may be conditionally accepted. It is your responsibility to ensure that your uploads are correct and complete.

Please note the submission dates and times for these assignments on the weekly schedule/breakdown table at the end of this document.

Quizzes:

One or two quizzes per week will be administered. Quizzes will generally be multiple-choice questions and will be posted on HuskyCT for you to complete online. No group consultations are allowed.

Please note the dates and times for these quizzes on the weekly schedule/breakdown table at the end of this document.

***Class Policies:***

No makeup exams or quizzes will be administered. Late homework assignments may be conditionally accepted. Exceptions may be made in extreme extenuating circumstances after conference with, substantiation, and approval of the instructor in accordance with UConn and School of Mechanical, Aerospace & Manufacturing Engineering policies.

Exams and assignments are expected to be submitted in a clear and organized manner, adhering to the generally accepted engineering presentation standards. This includes neatness, grammar, spelling, legibility, and work that is free of mathematical errors and plagiarism. No credit will be given for showing the answers only. Please show all your work for credit.

Important announcements will be posted periodically on HuskyCT. It is your responsibility to keep a track of these announcement/instructions.

Non-Disclosure Agreement:

All documents shared during the course are the property of University of Connecticut and may contain proprietary information. The contents of the documents should be treated as confidential and should not be disclosed to third parties.

Academic, Scholarly, and Professional Integrity and Misconduct (ASPIM):

This course will adhere to the University of Connecticut Community Standards and ASPIM policies. Cheating and copying of someone else's work is not tolerated and can result in severe consequences according to the existing University policies. Please review: <https://community.uconn.edu/academic-misconduct/> and <https://policy.uconn.edu/2023/07/11/academic-scholarly-and-professional-integrity-and-misconduct-aspim-policy-on/>

Conduct during the Course:

As a student enrolled in a University of Connecticut course you are considered part of our student community. As such, you are held to certain standards and academic policies. In addition, there are numerous resources available to help you succeed in your academic work. Please review the standards, policies and resources at: <https://community.uconn.edu/>

You are expected to communicate with your professor and your classmates in a respectful and professional manner. You are also expected to respect the virtual classroom environment and refrain from any disruptive behavior. This includes the online synchronous sessions as well as the online office hours. If



you fail to abide by the course conduct, you may be subjected to disciplinary actions according to the governing University of Connecticut policies.

Special Needs:

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/>



Tentative Schedule Breakdown

<u>Week</u>	<u>Topic</u>	<u>Reading Assignment</u>
1 (June 2)	<p style="text-align: center;">Summer 1 Semester starts June 2, 2025</p> <p style="text-align: center;">Introduction to the course.</p> <p style="text-align: center;"><u>Introductory Concepts and Useful Definition</u></p> <p style="text-align: center;">Systems, properties, states and processes Pressure, temperature and density Equilibrium Measurement units Methodology for solving thermodynamics problems.</p>	Chapter 1 (Sections 1.2 to 1.8)
	<p style="text-align: center;"><u>Energy and the First Law of Thermodynamics</u></p> <p style="text-align: center;">Mechanical concept of energy. Understanding of work. Understanding of energy. Energy transfer by heat. Energy balance for closed system (energy accounting). Energy analysis of cycles.</p> <p style="text-align: center;">Quiz # 1: June 6, 2025. Available from 6:00 PM to 11:59 PM</p> <p style="text-align: center;">Homework Assignment 1 due: June 6, 2024, before 5:00 PM</p>	Chapter 2 (Sections 2.1 to 2.6)
2 (Jun 3)	<p style="text-align: center;"><u>Evaluating Properties of Substances</u></p> <p style="text-align: center;">Phase and pure substances; State principle. Relationship between pressure, specific volume & temperature. Phase change. Retrieving thermodynamic properties. Evaluating pressure, specific volume, and temperature. Evaluating specific internal energy and enthalpy. Applying energy balance using property tables.</p> <p style="text-align: center;">Quiz # 2: June 11, 2025. Available from 6:00 PM to 11:59 PM</p> <p style="text-align: center;">Specific heats at constant volume and pressure.</p>	Chapter 3 (Sections 3.1 to 3.6 and 3.8 to 3.15)



	<p>Evaluating properties of liquids and solids. Generalized compressibility chart. Ideal gas model. Internal energy, enthalpy, and specific heats of ideal gases. Energy balance using ideal gas tables & constant specific heats. Polytropic process relations.</p> <p>Quiz # 3: June 13, 2025. Available from 6:00 PM to 11:59 PM</p> <p>Homework Assignment 2 due: June 13, 2025, before 5:00 PM</p>	
<p>3 (Jun 10)</p>	<p><u>Control Volume Analysis using Energy</u> Conservation of mass. Mass rate balance. Application of mass rate balance. Conservation of energy. Analyzing control volumes at steady state.</p> <p>Quiz # 4: June 18, 2025. Available from 6:00 PM to 11:59 PM</p> <p>Nozzles and diffusers. Turbines. Compressors and pumps. Heat exchangers. Throttling devices. System integration. Transient analysis.</p> <p>Review – Mid-Term Exam</p> <p>Homework Assignment 3 due: June 19, 2025, before 5:00 PM</p>	<p>Chapter 4 (Sections 4.1 to 4.12)</p>
	<p>Mid-Term Exam: June 20, 2025. Available from 9:00 AM to 11:59 PM</p>	



<p>4 (Jun 17)</p>	<p><u>The Second Law of Thermodynamics</u></p> <p>Introduction Irreversible and reversible processes. Statements of the second law. Applying the second law to thermodynamic cycles. Interpreting Kelvin-Planck Statement Second law aspects of power cycles (with two reservoirs).</p> <p>Quiz # 5: June 25, 2025. Available from 6:00 PM to 11:59 PM</p> <p>Second law aspects of refrigeration and heat pump cycles (with two reservoirs). Maximum performance measures for cycles (two reservoirs). Carnot cycle. Clausius inequality.</p> <p>Quiz # 6: June 27, 2025. Available from 6:00 PM to 11:59 PM</p> <p>Homework Assignment 4 due: June 27, 2025, before 5:00 PM</p>	<p>Chapter 5 (Sections 5.1 to 5.11)</p>
<p>5 (Jun 24)</p>	<p><u>Using Entropy</u></p> <p>Introduction to entropy. Entropy Statement Retrieving entropy data. Introducing $T ds$ equation. Entropy change of an incompressible substance. Entropy change of an ideal gas.</p> <p>Quiz # 7: July 2, 2025. Available from 6:00 PM to 11:59 PM</p> <p>Entropy balance for closed systems Directionality of processes. Entropy rate balance for control volumes. Rate balances for control volume at steady state. Isentropic processes. Isentropic efficiencies of thermodynamic machines. Heat transfer and work for internally reversible, steady-state processes.</p> <p>Homework Assignment 5 due: July 2, 2025, before 5:00 PM</p>	<p>Chapter 6 (Sections 6.1 to 6.7)</p>



	Final Exam: July 3, 2025. Available from 9:00 AM to 11:59 PM	
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The instructor reserves the right to revise course policies, procedures, and schedule as necessary.
All changes will be posted on HuskyCT.