University of Arkansas
Mechanical Engineering
MEEG 54003 - Advanced Thermodynamics – Online/On-Campus Hybrid Syllabus - Fall 2025
Course Materials on Blackboard

Instructor: Rick J. Couvillion, PhD, PE. Adjunct Professor, rjc@uark.edu

Text: None currently. Use instructor lecture notes that can be downloaded in the Weekly Lessons on Blackboard.

Previous Text: *Introduction to Thermodynamics - Classical and Statistical*, by Sonntag and Van Wylen, 3rd ed. Out of print.

References: *Thermodynamics*, by J. P. Holman, 1st ed; *Heat and Thermodynamics*, by Zemansky and Dittman; *Introduction to Physical Gas Dynamics*, by Vincenti and Kruger.

Prerequisites: Thermodynamics I, Excel, and Matlab skills.

Objectives: (1) Develop a comprehensive understanding of the basic principles and applications of classical thermodynamics and (2) provide an introduction to the concepts of microscopic thermodynamics, including classical quantum mechanics, elementary kinetic theory, molecular models, and statistical thermodynamics.

Communication - Official mode of communication is through uark.edu email. Students are responsible for checking their UARK accounts regularly. All communication between student and instructor and between student and student should be respectful and professional. If the class finds discussion groups useful, they can be set up on Blackboard.

Access to a reliable internet connection is required for this course. An internet access problem is not an excuse for late, missing, or incomplete coursework. If you experience problems with your internet connection while working on this course, it is your responsibility to find an alternative access point, such as a public library or wi-fi hotspot.

Lecture Notes and Recorded Lectures - Recorded lectures are accessed in the Weekly Lessons on Blackboard. There are lecture notes that cover the recorded lectures and are also available and can be downloaded in the Weekly Lessons. Course content and schedule are shown below.

Drills - There will usually be a live on-campus drill each week. Drills will focus on questions about the lectures and homework. Drills will be recorded and made available for streaming.

Homework - Homework done by hand should be scanned and submitted as a single pdf file. One or more programs may require computer programming using Excel, Basic, Matlab, Python, or C. Depending on the number of students, homework will simply be submitted by email, or submission on Blackboard will be set up.

Grade Basis - Three Exams - 80%. Homework - 20%. As indicated on the schedule below, Exam 01 will be at the end of week 4, Exam 02 at the end of week 9, and Exam 03 at the end of week 16. The exams could be take-home and/or paper-based on-campus.

Units - Making units mistakes is unacceptable for senior and graduate engineers and will be severely penalized. All results should have units. If a problem is stated in US units, it is to be worked in US units, not converted to SI and converted back to US. Recall that 1 lbf = 32.17 lbm-ft/s^2, 1 hp-s = 550 ft-lbf, 1 Btu = 778 ft-lbf.

Software - Excel and Visual Basic will be useful on some assignments. Install Excel's 'Solver' add-in. A spreadsheet with functions to calculate thermodynamic properties will be used on some problems; it's in the 'Downloads' folder on Blackboard.

Academic Honesty - Academic honesty is expected, and dishonesty as described in the UA academic integrity policy will be penalized. Penalties will range from getting zero on a homework, quiz, project, or exam to failure of the course and/or report to the College of Engineering Academic Integrity Monitor. However, these penalties will pale in comparison to the instructor knowing that you are a person who cannot be trusted. If a potential employer asks, the instructor will be obligated to express his concerns about your integrity.

Students are not permitted to collaborate on any quiz or exam without specific permission from the instructor in advance, including collaboration through GroupMe, WhatsApp, or any other form of technology to exchange information associated with a quiz or exam. Improper use of technology is considered academic misconduct that can result in the same penalties as cheating in a face-to-face (in person) class. Listed below are some of what is considered academic misconduct for quizzes or exams.

- Taking a screen shot of an online quiz or exam question, posting it to Chegg, CourseHero, GroupMe, WhatsApp, etc and asking for assistance.
- Answering an online quiz or exam question posted to Chegg, CourseHero, GroupMe, WhatsApp, etc.
- Giving advice, assistance, or suggestions on how to complete a question associated with a quiz or exam.
- The use of online websites (eg, Chegg) or search engines (eg, Google) when exam instructions indicate these are not allowed.
- Gathering to take an online quiz or exam with others and sharing answers in the process.
- Exchanging material associated with a quiz or exam through any form of technology (GroupMe, WhatsApp, etc.) or using any unauthorized resources (Googling answers, use of websites such as Course Hero, Chegg, etc).

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Tentative Schedule and Lectures - Fall 2025

Week	Lecture Notes	Recorded Lectures	Topics
1	Thermo Review	Review - 01	Laws of Nature
		Review - 02	Steady State Laws of Nature, Property Changes
2	Thermo Review	Review - 03	Property Diagrams, Ideal Gases, Solids & Liquids, Example
		Review - 04	Examples
3	Thermo Review	Review - 05	Device Efficiencies, Examples
		Review - 06	Examples, Engines, Refrigerators & Heat Pumps
4	01	01	Thermo Relations, Clapeyron Equation
			Exam 01 - Thermo Review
5	02	02	Enthalpy, Internal Energy, and Entropy Changes
	03	03	Equations of State, Generalized Charts
6	04	04	Development of Property Tables
	05	05	C_p, C_v Variation, Other Properties
	06	06	Fuels, Combustion, Enthalpy of Formation
7	07	07	First Law Analysis, Adiabatic Flame Temperature
	08	08	Entropy Change
8	09	09A, 09B	Chemical Equilibrium, Equilibrium Composition
			Review
9			Fall Break
			Exam 02 - Lecture Notes 01-09
10	10	10A, 10B	Kinetic Theory
11	11	11	Maxwell's Distribution
12	12	12	Transport Properties
13	13	13	Statistics of Independent Particles
14	14	14A, 14B	Quantum Mechanics, Equilibrium State, First Law
15			Thanksgiving Week
16	15	15	Entropy, Second Law
			Exam 03 - Lecture Notes 10-14