MEEG 2403 – 002 Thermodynamics

Spring 2024
Lecture: Tue/Thu 2 – 3:15 PM, JBHT 0234
Drill: Monday 5:15 PM – 6:05 PM

Instructor: Han Hu; MEEG Room 106; Email: hanhu@uark.edu; Phone: 479-575-6790 (office); 215-421-1908 (cell).

Office Hours: 3:15 – 4:15 PM on Tue/Thu.

Textbook: Cengel and Boles, Thermodynamics: An Engineering Approach, 10th ed. Other editions of the textbook are acceptable. Only hard copies of the textbook (including loose leaf) are allowed during exams.

Course Description: This course is designed to provide students with a comprehensive understanding of the basic concepts and laws governing thermodynamics, including energy, heat, work, etc., and their interactions in various systems. This course will also cover problem-solving methods for thermodynamics problems from states to processes and cycles, including the equation of state, and property tables, among others. The format of this course includes lectures, exams, in-class assignments, and homework assignments. This course also includes extra-credit assignments that are designed to help students practice four National Association of Colleges and Employers (NACE) competencies, including critical thinking, communication, technology, and professionalism.

Learning Objectives: Students will have a solid understanding of thermodynamic concepts and principles, be able to apply these concepts to solve real-world problems, and develop critical thinking skills, communication, and professionalism for an engineering career. The key topics that the students will be proficient in include:

- Properties of Pure Substances (liquids, vapors, and gases)
- The First Law of Thermodynamics: Closed and Open Systems
- The Second Law of Thermodynamics
- Entropy
- Power Cycles: Gas and Vapor
- Refrigeration Cycles

Prerequisite: PHYS 2054 and MATH 2564.

Academic Honesty: As a core part of its mission, the University of Arkansas provides students with the opportunity to further their educational goals through programs of study and research in an environment that promotes freedom of inquiry and academic responsibility. Accomplishing this mission is only possible when intellectual honesty and individual integrity prevail. Each University of Arkansas student is required to be familiar with and abide by the University's 'Academic Integrity Policy' which may be found at http://provost.uark.edu/. Students with questions about how these policies apply to a particular course or assignment should immediately contact Dr. Hu.

Students are not permitted to collaborate on any quiz or examination without specific permission from the instructor in advance. This includes collaboration through GroupMe, WhatsApp, or any other form of technology to exchange information associated with a quiz or examination.

The following is not all-inclusive of what is considered academic misconduct for quizzes or examinations. These examples show how the use of technology can be considered academic misconduct and could result in the same penalties as cheating in a face-to-face (in person) class:

- Taking a screenshot of an online quiz or exam question, posting it to GroupMe or WhatsApp, and asking for assistance is considered academic misconduct.
- Answering an online quiz or exam question posted to GroupMe or WhatsApp is considered academic misconduct.
- Giving advice, assistance, or suggestions on how to complete a question associated with a quiz or examination is considered academic misconduct.
- The use of online websites (Quizlet, Chegg) or search engines (Google) when exam instructions indicate these are not allowed is considered academic misconduct.
- Gathering to take an online quiz or exam with others and sharing answers in the process is considered academic misconduct.

Please note: If a student or group of students are found to be exchanging material associated with a quiz or examination through any form of technology (GroupMe, WhatsApp, *etc.*) or using any unauthorized resources (Googling answers, use of websites such as Quizlet, Course Hero, Chegg, etc.), I am required to report this matter per the University of Arkansas Academic Integrity Policy.

There are many websites claiming to offer study aids to students, but in using such websites, students could find themselves in violation of our University's Academic Integrity and Code of Student Life policies. These websites include (but are not limited to) Quizlet, Bartleby, Course Hero, Chegg, and Clutch Prep. The U of A does not endorse the use of these products in an unethical manner. These websites may encourage students to upload course materials, such as test questions, individual assignments, and examples of graded material. Such materials are the intellectual property of instructors, the university, or publishers and may not be distributed without prior authorization. Furthermore, paying for academic work to be completed on your behalf and submitting it for academic credit is considered 'contract cheating' per the Academic Integrity Policy. Students found responsible for this type of violation face a grading penalty of 'XF' and a minimum one-semester academic suspension per the *University of Arkansas Sanction Rubric*. Please let me know if you are uncertain about the use of a website.

Communication: Besides lectures, drills, office hours, our 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.

Student Accommodations: University of Arkansas *Academic Policy Series 1520.10* requires that students with disabilities are provided reasonable accommodations to ensure their equal access to course content. If you have a documented disability and require accommodations, please contact me privately to make arrangements for necessary classroom adjustments. Please note, you must

first verify your eligibility for these through the Center for Educational Access (contact ada@uark.edu or visit *http://cea.uark.edu* for more information on registration procedures).

Use of Generative AI: Students have permission to use generative artificial intelligence tools in any capacity to complete academic work in this course. Please be aware of the limitations of such tools and verify the accuracy of the content generated before submitting any work for credit. Additionally, you are expected to properly attribute any content generated by artificial intelligence tools using the following format:

- *If AI is only used for polishing your writing:* [AI Tool/Model Name] was used to improve the readability and language of writing but was not used to generate any content.
- *If the content includes your input or editing:* This [content] (text/image/etc.) was generated by [AI Tool/Model Name] with human-guided prompts and editing.
- *If the content is completely generated by AI:* This [content] (text/image/etc.) was generated by [AI Tool/Model Name].

Please refer to the examples/guidance provided by this University of Arkansas Library Research Guide on AI and Academic Integrity for more information. The use of content generated by artificial intelligence, without proper citation, will be considered academic dishonesty and reported to the Office of Academic Initiatives and Integrity.

Grading Policy:

In-Class Assignments & Quizzes	20%	20 points
Exam 1	20%	20 points
Exam 2	20%	20 points
Exam 3 (Final Exam)	40%	40 points
Total	100%	100 Points

Grading Scale: 90's = A, 80's = B, 70's = C, 60's = D, Below 60's = F

In-Class Assignments and Quizzes: There will be ten in-class assignments throughout the semester, with each of them accounting for 1% of the total grade. In-class assignments will not be graded as they may cover new topics that have not been discussed before. Students will get full credits for in-class assignments as long as they submit their answers during the lectures. If a student cannot attend a lecture, she/he should email the instructor before the lecture starts. In that way, the student will have the chance to take a makeup in-class assignment and get the full credits by submitting the answers before the next lecture. If a student missed an in-class assignment and didn't inform the instructor before the lecture started, she/he would still have a chance to earn partial credits by taking markup in-class assignments before the last day of class. But the student could at most get 30% of the full credits.

There will be two quizzes with each of them accounting for 5% of the total grade. Quizzes will be given during drill hours. The dates of the quizzes will be announced at least one week before the quizzes. Quizzes will only cover topics that have been discussed in previous lectures and will be

graded. The grade of the quizzes will be posted on Blackboard Learn within one week. Students should contact the instructor as soon as possible if they have questions related to their grades. The grade of the quizzes will not be changed two weeks after the quizzes. Students should email the instructor before the quizzes if they cannot take them. No makeup assignments or quizzes will be given if the students miss the class without prior notice or last-minute legitimate emergencies.

Homework: Homework problems and the solution to the problems will be posted on Blackboard Learn. Students don't need to turn in their homework. The instructor will ask students' feedback on the homework problems every other week and will use the drill to explain the problems that students have difficulty with.

Exams: Two exams will be given during the semester and one exam will be given in the finals week. Exams 1 and 2 will only cover the topics discussed one week before the exams. The final exam will be comprehensive and cover all the topics discussed in the class.

The grade of the exams will be posted on Blackboard Learn within one week. The students should contact the instructor as soon as possible if they have questions related to their grades. The grade of Exam 1 & 2 will not be changed two weeks after the exams. The grade of the final exam will be not changed after the finals week.

Exam Rules: The students are allowed to use their textbook and a single-page letter-size cheat sheet during the exams. If the students take any electronic devices that can be connected to the Internet, they should take on the airplane mode and are not allowed to use the devices during the exam. All the materials must be kept on the desk. Discussions are not allowed between students during the exam. If a student needs any assistance, directly ask the instructor or the teaching assistant.

Attendance for the exams is mandatory. Makeup exams will be given only with prior arrangements or legitimate last-minute emergencies. If you cannot be present for an exam, for any reason, you must contact the instructor before the exam begins. Proof of absence reason may be required.

Extra-Credit Assignments: Optional extra-credit assignment opportunities are provided to all students in the class. The total extra credit that a student will receive from Assignments 3-5 is limited to 1.5%.

A. **Test Correction (range: 0 – 50% of credits missed in Exam 1 & 2; target: participants):** Students can request to take test correction for Exam 1 and/or Exam 2 within two weeks of the exams being finished. Test correction will be given during drill hours. Students will be asked to work on problems that are similar to Exam 1 and/or Exam 2. If they work out the problems correctly, they can earn extra credits up to 50% of the points they missed during the exams. Test correction will be provided for both Exam 1 and Exam 2, but not for the Final Exam. Each student can only take test correction once for each Exam (Exam 1 and Exam 2 only). ***This assignment builds a variety of career skills that are transferable across jobs and industries including: Communication, Critical Thinking, and Professionalism.***

B. **Course Evaluation Participation (range: 0 – 1%; target: whole class):** For a class with N students, if M students submit course evaluation by the deadline, everyone in the class will be awarded an extra credit of (M/N) × 1%.
C. **Mini Lecture (range: 0 – 1%; target: participants):** Students can apply to give a mini-lecture in the class, including explaining a concept with real-life examples, introducing their method of solving homework/test problems, etc. The topics of the mini-lecture will be announced by the instructor during the semester. Students can also propose topics and are free to decide on the format of the lectures (presentation slides, animations, whiteboards, etc.) ***This assignment builds a variety of career skills that are transferable across jobs and industries including: Communication, Critical Thinking, Technology, and Professionalism.***
D. **Short Essay on the Impact of Data Science/Artificial Intelligence/Machine Learning on Thermodynamics (range: 0 – 1%; target: participants):** Students can write short essays to explain their understanding of how data science, AI, machine learning may affect thermodynamics, and it can cover one or multiple of the following aspects: education and learning, research and discoveries, and industrial applications. ***This assignment builds a variety of career skills that are transferable across jobs and industries including: Communication, Critical Thinking, Technology, and Professionalism.***
E. **Thermodynamic Cycle Visualization Tool Evaluation (range: 0 – 1%; target: participants):** Students can write review reports to explain how a visualization tool may help them understand the concepts and any recommendations to improve the tool. The tools to evaluate may include the "Gas Power Cycle Applets" by McGraw Hill Education: https://semmedia.mhhe.com/engineering/Gas_Power_Cycle_Applets/index.html, the "Thermodynamic Cycle Visualization" tool developed by DALI Lab at Dartmouth College: https://tcv.onrender.com/#/carnot, or any other tools identified by the student. ***This assignment builds a variety of career skills that are transferable across jobs and industries including: Communication, Critical Thinking, Technology, and Professionalism.***

Grading Policies for 3-5: Extra-credit assignments C-E will be graded following the policy below: This assignment will be peer reviewed by the rest of the class on a 1-5 scale, with 1 representing very negative, 2 negative, 3 neutral, 4 positive, and 5 very positive. If the average score of the presenter is 3 or below, they will not receive any extra credit. If their score is larger than 3 (denoted by X), the extra credit they will receive will be (X – 3) / (5 – 3) × 1%.