

# MECH 3312 Thermodynamics

## Course Syllabus

### Fall 2024

#### COURSE MOTIVATION

- Continuation of learning the basic principles of thermodynamics started in MECH 2311 “Introduction to Thermal-Fluid Sciences”
- Application of these principles to the analysis of power and refrigeration cycles as well as to engineering problems involving psychometrics and air conditioning

#### SCHEDULED MEETING TIMES

Section CRN	Time	Location
12545	T R 09:00 am - 10:20 am	Liberal Arts Building 319

**INSTRUCTOR:** Dr. Md Mahamudur Rahman

**E-MAIL:** [mrahman15@utep.edu](mailto:mrahman15@utep.edu)

**OFFICE HOURS:** By Appointment (via e-mail)

**OFFICE:** Engr. Bldg. A#118

**TEXTBOOK:** Y.A. Çengel and M.A. Boles, *Thermodynamics: An Engineering Approach*, 7th Edition, McGraw-Hill, ISBN 9780073529325

**BLACKBOARD:** Instructor will be using Blackboard for uploading lecture videos, updating the syllabus (if necessary), and communicating with students via “Announcements” and email.

**COURSE OBJECTIVES:** The student, upon completion of this course, will be able to:

- Analyze thermodynamic systems, processes and power/refrigeration cycles using the laws of thermodynamics.
- Determine the appropriate thermodynamic state of a system using equations of state, correlations, and tabulated information for typical gases and water.
- State the composition of mixtures on both gravimetric and volumetric bases and calculate the thermodynamic properties of mixtures of ideal and real gases.
- Balance chemical reactions describing an overall combustion process, perform energy analysis of combustion systems and calculate the adiabatic flame temperature.
- Design a practical power cycle to specified requirements.
- Perform energy analyses of air-water-vapor mixtures that are important in HVAC applications, using both fundamental models of mixing and psychrometric charts.

#### TOPICS

1. First and second laws of thermodynamics
2. Chemical and phase equilibrium
3. Thermodynamic processes and devices
4. Fundamentals of theoretical, power and refrigeration cycles
5. Description and calculations relating to gas mixtures
6. Air-conditioning and problems relating to air-water vapor mixtures
7. Introduction to chemical reactions on a first law of thermodynamics basis

## COURSE SCHEDULE

Week	Week of	Chap.	Lecture Topic	Due
1	08/26	1,2,3	1. Introduction and Basic Concepts 2. Energy, Energy Transfer, and General Energy Analysis 3. Properties of Pure Substances	
2	09/02	4,5	4. Energy Analysis of Closed Systems 5. Mass and Energy Analysis of Control Volumes	HW-1 (Ch. 1-3)
3	09/09	6,7	<b>6. Quiz-1 (Ch. 1-3)</b> 7. The Second Law of Thermodynamics 8. Entropy	<b>Quiz-1</b>
4	09/16	10	9. Vapor and combined power cycles <b>10. Project and Group Assignment</b>	HW-2 (Ch. 4-6)
5	09/23	10	<b>11. Exam-1 (Ch. 1-7) Online</b> 12. Vapor and combined power cycles	<b>Exam-1</b>
6	09/30	10	13. Vapor and combined power cycles	HW-3 (Ch. 10)
7	10/07	9	<b>14. Quiz-2 (Ch. 10)</b> 15. Gas Power Cycles	<b>Quiz-2</b>
8	10/14	9	16. Gas Power Cycles <b>17. Project Proposal Due</b>	<b>Proposal</b>
9	10/21	11	18. Refrigeration cycles <b>19. Quiz-3 (Ch. 9)</b>	HW-4 (Ch. 9) <b>Quiz-3</b>
10	10/28	11	20. Refrigeration cycles	HW-5 (Ch. 11)
11	11/04	12	<b>21. Exam-2 (Ch. 9-11)</b> 22. Thermodynamic Property Relations	<b>Exam-2</b>
12	11/11	13,14	23. Gas mixtures 24. Gas-vapor mixtures and air-conditioning	HW-6 (Ch.12)
13	11/18	15	25. Chemical Reactions	HW-7 (Ch.13-14)
14	11/25		<b>26. Quiz-4 (Ch. 13-14)</b> <b>27. Final Project Report Due</b> <b>28. No class on 11/28: Thanksgiving Holiday</b>	<b>Quiz-4</b> <b>Project Report</b>
15	12/02		<b>29. Exam-3 (Ch. 12-15)</b>	<b>Exam-3</b>

**GRADING:** Your grade for the course will be determined using the following formula:

Exams	20% Each	× 3	60%
Class Project	10%	× 1	10%
Quizzes	10%		10%
Homework	10%		10%
Class Participation	10%		10%

*A (100-90): B (89-80): C (79-70): D (69-60): F (59 and below)*

## Detailed instructions on lectures, class participations, quizzes, exams and projects are given below.

### LECTURES

- In addition to in-person lectures, voice over presentations on the lecture topics (pre-recorded during the pandemic) will be provided for each class.
- The videos will be uploaded in the blackboard under “Lectures” folder.
- Pre-recorded lecture video links will be shared at least 24 hours before the designated lecture schedule.
- If required, we can even talk personally on-campus or using other virtual mediums. For that, please send me an e-mail.

### IN-CLASS PARTICIPATION (ICP)

- The ICP questions will be provided during the lecture sessions.
- You will have to follow the lectures and then solve the problems as directed.
- You can simply take pictures or scan your solution and upload it to the blackboard under the designated assignment. You can also use Microsoft office (word, power point etc.) as well to answer your ICP questions.
- You will be given 24 hours after the lecture schedule to upload your ICP solution.
- Additionally, there will be ICPs during the class that will be collected during the class.

### QUIZZES AND EXAMS

- The quizzes and exams will be open book, open note, and open resources.
- The quizzes and exams will be in-class or online, which will be announced earlier.
- If scheduled online, then the questions will be available on the scheduled date and time. The question will remain for 24 hours on the scheduled date.
- Whenever you access the question, you will have the designated time (as specified in the questions) to answer and upload your answer in the blackboard.
- Upload time beyond the designated time will be considered as “Late Submission” with deducted points.
- No makeup exams will be given. See Section “Department’s Policies” for more information on the exam rules.

### PROJECT WORK

- There will be team project work in this course. This is not a lab based; instead, you will perform analytical thermodynamic analysis of various real-world systems.
- I will create teams of 4-5 members based on your topic selection.
- You can use “**collaborate and edit in Google Docs**” to work in-group and create a single project proposal and final report document. Team lead can create this file and share it with others.  
<https://www.youtube.com/watch?v=Brse6eeekus>
- Each member should have a dedicated objective to complete this project.
- The team lead will collect all the materials for each member, combine them, and upload them to the blackboard as a single PDF file.
- Please keep in mind that “the final individual project score will be calculated based on the following procedure:
  - I will give a graded score on the project proposal and report. This will be common grade.
  - Your individual score will be calculated based on your “self and peer evaluation”. I will calculate the percentage of how you grade yourself and your group members grade you.
  - The final individual project score will be the common grade multiplied by the percentage.
  - I will provide this “**Self and Peer Evaluation**” form in the blackboard.

## ASSIGNMENTS

Homework assignments will be given during the semester. They might include concept questions and problems. The solutions of assigned homework problems will be collected and graded. If you have any difficulties in solving the assigned problems and need help, you are encouraged to contact the instructor and teaching assistant.

**ABET PROGRAM OUTCOMES:** This class addresses the following ABET objectives:

Outcomes 1 - 7	Evidence
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Homework; Exams; Quizzes; Design project
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	N/A
3. An ability to communicate effectively with a range of audiences	Design project report and presentation
4. An ability to recognize ethical and professional responsibilities in engineering solutions and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts	Classroom discussion of sustainability. Design project
5. An ability to function effectively on a team whose members together provide leadership, create collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Design project
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions	Design project; classroom example and homework problems
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Homework; Final report for the design project

**ACCOMODATIONS:** If you have a disability and need classroom accommodations, please contact the Center for Accommodations and Support Services (CASS) at 747-5148, or by email to [cass@utep.edu](mailto:cass@utep.edu), or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at [www.sa.utep.edu/cass](http://www.sa.utep.edu/cass).

## Department's Policies

### ACADEMIC HONESTY

During exams and quizzes, you are not allowed to use any form of wifi enabled electronic device, including cell phones or other electronic communication devices or methods (wrist watches, earbuds, etc.). No wrist watch or other electronic device may be worn. Calculators and watches may be subject to inspection. You may be asked to temporarily remove glasses to allow for their inspection.

You may not bring backpacks, hats, bulky coats or hoodies into the exam room. Lockers are not available at the exam site so plan and leave your belongings in a secure location. You may NOT sit them in a corner of the exam room.

You must show your work for all problems. You must use the paper provided by the instructor. If no work is shown you may not receive credit. After the exam, the instructor may require you to explain how you solved a problem on the exam. If you refuse to or cannot explain your work you may be subject to disciplinary action.

No electronic version of the book, loose paper print-outs of the book or extra sheets of paper of any kind are allowed unless explicitly mentioned in writing by the instructor. As a part of the zero-tolerance policy, if you have a cellphone or other electronic device capable of communication on your person; or if any proctor sees or hears any electronic device during the exam or if you share your work with someone else, you will be reported to the proper authorities and you may receive a zero on the exam or an F in the class. Other actions including suspension may also be pursued.

No one will be allowed to leave the room during an exam. This includes restroom breaks.

University approved recording devices may be located at various locations in the room and may be out of sight of the students. These recordings will be managed according to the UTEP approved regulations for such media. The instructor may create a record of your activity during the exam and may take photographs of your work during the exam.

If you are suspected of scholastic dishonesty you may or may not be directly confronted about your conduct by the instructor or proctor. You will however, be reported to the Office of Student Conduct and Conflict Resolution (OSCCR) and your exam may not be admissible. Your grade in the class may not be available until OSCCR makes a final ruling, this may adversely impact your ability to enroll in other classes.

If you arrive more than 15 minutes late to an exam, you will not be allowed to take the examination. There will be no makeup exams administered. If you have a university approved excuse, your instructor will have a process for determining how to handle the missing grade outlined in the syllabus. However, no makeup exams will be given.

If you miss more than one exam, the instructor may choose to administratively drop you from the class. This may adversely impact a visa and financial aid.

No food or drink may be brought into the examination room.

Departmental policy allows for the use of assigned seats. All students must present their UTEP issued ID prior to and during every exam and may be required to sign in. Not having a UTEP issued ID when asked will result in forfeiture of the exam. No other IDs will be accepted.

Scholastic dishonesty on homework, lab assignments and all other class assignments will be held to the same standards and requirements of academic honesty as quizzes and exams.

### **CLASS ATTENDANCE POLICY**

Attendance is mandatory. Anyone with 5 or more absences will be dropped from the class. A drop for not attending will count toward the State Allowed Six Drop Limit. If you are failing the class at the time of the drop you may also be given a WF designation. Be advised that a drop could adversely impact visa status, financial aid and other programs.

As per UTEP rules, you may be asked to show a UTEP ID at any time during class. Anyone who is present and not registered in the class will be subject to disciplinary action unless the instructor gives prior approval.

## **EXCUSED ABSENCE FOR EXAMS**

The UTEP catalog allows Exam Absence to be excused ONLY for University-Recognized Activities and very specific other situations. Medical absence is NOT allowed in the UTEP catalog. For consistency with the catalog, students will NOT be excused from exams due to illness.

## **HARASSMENT POLICY**

The University (see Handbook of Operating Procedures 1.2.2.4) has a zero-tolerance policy for harassment. Engagement in any behavior considered harassment will be reported to the proper authorities. In addition to generally understood forms of harassment, the department also treats the following behavior as harassment:

- Repeated emails and/or calls regarding subjects that have already been addressed. Once a decision has been made or a question answered, a student who continues to ask the same question will be given a warning by the recipient of the email/call. If the student continues, the behavior will be reported. Questions that seek understanding of course material are not harassment; but repeated questions about a grade or an administrative decision are.
- Grades are NOT negotiable, ever. If you believe a grading mistake has been made, you must follow the process described in the UTEP catalog. Any request for a grade elevation that is NOT based on a mistake is considered harassment and will be reported immediately.
- Remaining in an office after the occupant requests you leave is considered harassment and potentially threatening. You will be reported immediately without warning and depending on the severity, may be reported to law enforcement.

Similar behavior towards department staff, and student advisors will also be treated as harassment, including persistent phone calls, emails, and badgering. Department staff and student advisors are there to help students, and should be treated with due respect.

### **Few Notes**

- If you face any issue with anything, please send me an e-mail. In that case, I will definitely arrange something for you.
- All the due dates and times are specified in the associated questions (say quizzes, exams, and projects). Please follow them.
- I am sure we all will definitely have an excellent semester in this course!

**Best of Luck!**

**I am always with you to help!**

**Stay Safe and Take Care of Your Family!**

**Relax and Smile!**