

### Applied Thermodynamics ME EN 422 Fall 2025

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Class: M,W,F 369 CB 1-2 pm Prerequisites: ME EN 321

Required Text: *Thermodynamics, an Engineering Approach*, 10<sup>th</sup> Edition , By: Y. Cengel and M. Boles, Kanoglu, M.

Date	Class Material or Reading	Formative Hmwk.	Sum. Hmwk	Due	Reading 10 <sup>th</sup> Edition
Sep. 3	Chp. 1-6 Syllabus, Energy and Entropy Eqns.	#1 4_24, 60E, 76, 115	4_62	Sep. 9	1-5
Sep. 5	Chp. 1-5 Energy Eqn. Review	5_44, 81, 120, 123	5_46		5-7
<b>M Sep. 8</b>	Chp. 6-7 Entropy Eqn. Review	7_133E			8
Sep. 10	Chp. 7 Entropy Eqn. Review	#2 7_136, 7_141, 8_12, 8_14, 8_20E, 8_21	7_154	Sep. 16	8
Sep. 12	Chp. 8.1-8.2 Exergy, Rev. Work, Irreversibility	8_22E, 8:28	8_17, 8_23		9.1 – 9.3
<b>M Sep. 15</b>	Chp. 8.3 Second Law Eff.				9.4 – 9.6
Sep. 17	Chp. 8.4 Exergy Equation	#3 8_33, 51, 59, 63, 66, 80	8_58, 76E	Sep. 23	9.7 – 9.8
Sep. 19	Chp. 8.5-8.7 Exergy Open, Closed Systems				9.7 – 9.8
<b>M Sep. 22</b>	Chp. 8.7-8.9 Exergy Open, Closed Systems				9.7 – 9.8
W Sep. 24	Review				
F Sep. 26	Exam 1 Chps 1-8				
Sep. 29	Chp 12 Return Exam, Thermo. Prop.				11:2
Oct. 1	Chp. 12 Thermodynamic Properties, Maxwell's relations	#4 12_5, 12_16, 12_17, 12_40, 12_43	12_28E, 94E	Oct 7	11:3
Oct. 3	Chp. 12 H, U, S, C <sub>p</sub> , C <sub>v</sub> , and Joule Thompson	59, 61E, 72, 79, 92			12:4-6
<b>Oct. 6</b>	Chp. 12 Enthalpy Change of Real Gas, Tables				13:1-2
Oct. 8	Chap. 13 Mixtures	#5 13_11, 32, 37, 53	13_50, 14_41	Oct. 14	13:3-4
Oct. 10	Chp. 13 Gas Mixtures, Dalton's, Amagat's Laws	14_25, 31E, 39			14:1-3
<b>Oct. 13</b>	Chp. 14 Humidity, Dew Point				14:4-5
Oct. 15	Chp. 14 Wet Bulb Temp., Psych. Chart	#6 14_64, 76, 85, 94, 109, 122E, 136	14_73, 87, 100,	Oct. 21	
	Begin Lab 1: Swamp Cooler – Full Report	Swamp Cooler Lab		Oct 28	14:6
Oct. 17	Chp. 14 Air Conditioning, Swamp Coolers				14:7
<b>Oct. 20</b>	Chp. 14 Mixing or Air streams				
Oct. 22	Review				
Oct. 24	Exam				15:1,2
<b>Oct. 27</b>	Chp. 15 Ideal Combustion	Swamp Cooler Report Due		Oct. 28	
Oct. 29	Chp. 15 Enthalpy of Combustion	#7 15_15, 19, 22, 42, 54E, 56, 73	15_17, 56,	Nov. 4	15:3
Oct. 31	Chp. 15 Adiabatic Flame Temp.				15:4,5
<b>Nov. 3</b>	Chp. 15 Adiabatic Flame Temp.				
Nov. 5	Chp. 9 Otto, Diesel,	#8 9_33, 50, 71, 72E, 87, 109, 144	9_36E, 104, 146	Nov. 11	
Nov. 7	Chp. 9 Stirling, Ericsson				15:6-7
<b>Nov. 10</b>	Chp. 9 Brayton, Brayton with regeneration				15:8
Nov. 12	Chp. 9 Brayton, 2 <sup>nd</sup> law	#9 10_34, 48, 69, 77	10_72	Nov. 18	9:1-4
Nov. 14	Chp. 10 Rankine Cycle				9:5-7
<b>Nov. 17</b>	Chp. 10 Rankine Cycle				9:8
Nov. 19	Review				
Nov. 21	Exam				9:9-10
<b>Nov. 24</b>	Chp. 11 Ideal Vap. Refrigeration Cycle	#10 11_13, 17, 32a,b, 43, 87E	11_58	Dec. 5	9:12-13
<b>Dec. 1</b>	Chp. 11 Actual Vap. Refrig. Cycle				
Dec. 3	Chp. 11 Cascade, and Absorption Refrig. Cycles				
Dec. 5	Chp 18 Renewables	#11 18_3, 4	18_30	Dec. 10	10:1-4
<b>Dec. 8</b>	Chp 18 Renewables				10:5-6
Dec. 10	Review				10:7
Dec. 15	Final Exam 11 a.m. – 2 p.m.				10:8-11

The instructor reserves the right to make changes in this schedule and in the course policy, procedures and grading with advanced notice to the students.

## **Class Operations**

**Reading Assignments:** Suggested reading material is given in the table above. We will cover chapters 8-15 and it is suggested that you skim the text proceeding the lecture on the topic. After the lecture and homework have identified the content you need to understand, read slowly and carefully areas of the text where you need an improved understanding and of specific content needed.

**Quizzes:** There will be approximately 10 - 15 quizzes per semester. Quizzes will be **unannounced** and may occur at **any time** during any class. They will be short, approximately 5 minutes long. Each quiz will be worth 10 points and will cover material identified in previous lectures. The best way to study for quizzes is to listen carefully in class for hints on what will be covered in the quiz and then review a few minutes before class. **There will be no make up quizzes.** You may drop two quizzes. **Do not ask me to make up a quiz** unless you have already missed two quizzes. If you miss more than two quizzes and have good reasons, see me and we will work out something equitable.

**Homework:** Homework will be due at 11:55pm on the designated date. Turn in two separate digital documents for each assignment. One is formative and the other summative. The solution for each assignment will be posted right after the assignment is due. There will be no late homework accepted.

**Formative Homework** – The intent of this homework is to help you learn. You should attempt the problem first on your own but if you are stuck or need help you are encouraged to ask a friend, TA, instructor or use an AI tool such as chat GPT. **Comparing your solution with an AI solution or the solution manual is encouraged** before the work is turned in. You should not copy the work of others, but you may use the work of others to assess your work and adjust it before you turn it in.

**Summative Homework:** These problems are intended to help you test yourself and your ability to solve problems independently. **You may not use AI tools or the solution manual to guide or assess your work on these problems.** The work you turn in for these problems should represent your ability to solve the problem and not the work of others. You may ask the TA, the instructor or a classmate for help. When you grade these Summative problems, the rubric will ask you to validate the independence of your work.

**Grading:** The solutions to all problems will be posted within 10 minutes of the due date and time. Each student should then grade their own problems and post their score on learning suite within 24 hrs. The homework rubric and procedure are outlined in a separate document posted on learning suite.

**Late Homework:** **Late homework will generally not be accepted.** One exception for each student will be granted for those who miss the grading deadline.

**Labs:** There will be one lab experience during the semester with the intention of improving technical writing. It will be a walk-in lab experience and will be described in a separated document.

**Lab Write - Ups:** Student may work in teams of 2 or individually to design their experiment and collect data but each individual will write a separate lab report.

**Exams:** You will have three exams and a final. **The exams will all be in-class.** The final will be given on the date and time designated by the university. **You must be present in person and take the final in the classroom at the designated time.**

**Exam grading:** I want to correct any grading errors. Submit mis-graded exams to me with a written explanation or a note pointing out the area you would like to have re-graded. **Do not submit exams for re-grade when you are seeking a one or two point correction because you feel the grading was too severe.** Talk to me or a TA whenever you do not understand an exam problem.

**Grading:** A final score will be obtained from a weighted average. The weighting for the grades is shown below. The grade scale will not be increased to make a grade more difficult to obtain but the scale may be lowered if the class GPA falls below 3.1. **I do not use Learning Suite to Calculate the Grade**

Practice Hmwk: 15%    Mastery Hmwk 15%    Exams: 35%    Final Exam: 25%    Quizzes: 5%  
Lab Report 5%

93 -100 A	73 - 77 C
90 - 93 A-	70 - 73 C-
87 - 90 B+	67 - 70 D+
83 - 87 B	63 - 67 D
80 - 83 B-	60 - 63 D-
77 - 80 C+	below 60 E

### Self-Grading of homework

Homework will be self-graded by taking a homework quiz and answering the questions on the homework quiz. The following is a rubric that will represent the scoring the will be present in the quiz.

#### For a typical Formative Homework problem worth 10 pts.

##### 1. Demonstrated Attempt Using a Structured Approach: 0 – 4 pts

The written approach contains a structure including given information (Given:), requested information (Find:) assumptions, diagrams, control volumes, a step-by-step approach, identified solution and summary comment.

##### 2. Fundamental Concepts Demonstrated: 0 – 4 pts

The written solution uses fundamental concepts correctly and demonstrates a correct understanding of the concepts.

##### 3. Correct Answer: 0 – 2 pts

The answer is correct. The answer should match the posted solution within reasonable error limits. Calculation errors, sign errors, incorrect table lookup, unit conversions etc. are examples of these errors.

#### For a typical Summative Homework problem worth 10 pts.

##### 1. Demonstrated Attempt Using a Structured Approach 0 – 4 pts

The written approach contains a structured including given information (Given:), requested information (Find:) assumptions, diagrams, control volumes, a step-by-step approach, identified solution and summary comment.

##### 2. Fundamental Concepts Demonstrated 0 – 4 pts

The written solution uses fundamental concepts correctly and demonstrates a correct understanding of the concepts.

##### 3. Correct Answer: 0 – 2

The answer is correct. The answer should match the posted solution within reasonable error limits. Calculation errors, sign errors, incorrect table lookup, unit conversions etc. are examples of these errors.

##### 4. Intellectual Integrity - If this answer is false, the score for the homework problem is -10 pts.

True or False – The work represented is my own. I did not use an AI tool, a solution manual, or copy someone else's work. I may have conversed with a fellow student or a TA to get ideas. I may have also asked questions and received answers interacting with a human but after doing so, I understood what is written and can explain and fully understand the reasoning and work presented. I may have also read the book or sought answers to conceptual questions on the internet or through AI, but I did not seek a specific answer to the homework question.

## **Problem Solving**

Each student can identify issues related to thermodynamics in real world problems, use basic concepts and fundamental laws to construct thermodynamic models, apply mathematical principles to solve these models, draw conclusions based on these solutions and formulate sound recommendations based on these conclusions.

## **Concepts and Laws of Thermodynamics**

Each student can select a system, identify the heat, work, exergy and mass flow interactions occurring between the system and its surroundings and build models of steady-flow devices and transient thermodynamic systems.

## **Thermodynamic Property Relationships**

Each student can use thermodynamic concepts and laws to develop relationships between observable thermodynamic properties and thermodynamic properties that cannot be directly measured.

## **Gas Power Cycles**

Each student can use the basic concepts and fundamental laws of thermodynamics to model the performance of various gas power cycles. Each student can evaluate the impact of modifications such as reheat, regeneration and intercooling on the efficiency and net power produced by a gas power cycle and draw conclusions regarding the implementation of these modifications.

## **Jet Propulsion Cycles**

Each student can use the basic concepts and fundamental laws of thermodynamics to analyze, evaluate and draw conclusions regarding the performance of jet propulsion cycles.

## **Vapor Power Cycles**

Each student can use the basic concepts and fundamental laws of thermodynamics to analyze, evaluate and draw conclusions regarding the performance of Rankine cycles, geothermal power cycles, and combined cycles.

## **Refrigeration Cycles**

Each student can use the basic concepts and fundamental laws of thermodynamics to analyze, evaluate and draw conclusions regarding the performance of vapor-compression refrigeration cycles, absorption refrigeration cycles, multistage refrigeration cycles and cascade refrigeration cycles.

## **Alternative Energy Systems**

Each student can use the concepts and laws of thermodynamics to analyze and evaluate renewable energy systems and to draw conclusions regarding the performance of these systems.

## **Psychometrics**

Each student can calculate the properties of mixtures of air and water vapor to analyze, evaluate and draw conclusions regarding the performance of evaporative cooling systems, cooling towers, humidifiers and dehumidifiers.