ME 300 Engineering Thermodynamics
Fall 2024

Sample Syllabus

Textbook: *Thermodynamics: An Engineering Approach*, McGraw-Hill Education, by Yunus Cengel & Michael Boles, 2014.

Course URL: canvas.psu.edu (logon and you will see the ME300 webpage in your folder)

Prerequisites: CHEM 110 and MATH 141

Instructor: Dr. Yuan Xuan
Associate Professor of Mechanical Engineering
E-mail yux19@psu.edu
Office: 105 Research East
The best way to get me is by e-mail.

Teaching Assistants: Chun-sen Liu (cpl5586@psu.edu)

Office Hours: Tuesday 12:30PM – 2PM in 007 EDI Building
Thursday 11AM – 12:30PM in 314 Hammond Building

Course Description: Engineering Thermodynamics I. Basic thermodynamics concepts, properties of pure substances, first and second law, analysis of systems and control volumes.

Grading:

Homework (13, drop the lowest 2):	20%
Quizzes (5, drop the lowest 1):	20%
Exams (3):	60%
Late drops prior to first exam	-WN
Late drops after first exam:	
With a score ≥ 60%	-WP
With a score < 60%	-WF

Grading	**Scale**
A	93
A-	90
B+	87
B	83
B-	80
C+	77
C	70
D	60

*To pass this course, your average in-class exam scores must be 60% or greater. Homework scores cannot be used to move from a failing to a passing course grade.

Contesting Grade: We are all human, and there may be grading mistakes from time to time. If you have an issue with how an assignment was graded, please provide a formal application for grade change, including a copy of the particular question and your original answer, and a paragraph explaining why you believe you deserve a grade change. These applications should be emailed to me and the TA NO LATER than 24 HOURS

after the assignment was returned; verbal requests for grade change will not be considered. If there was an obvious mistake in grading, the TA and I will immediately correct the issue. If the grade change is more subjective in nature, I will file your request and reconsider at the end of the semester if a change in this grade could change your final grade in the class.

Missed Exams/Quizzes: No make-up exams or quizzes will be given except as required by University policy. See me ***prior*** to any anticipated absence.

Academic Dishonesty:
Academic dishonesty will not be tolerated ***at all***. I hope that everyone can develop enough pride in his or her own work and abilities that this will never be a problem. It is encouraged, however, to discuss problems solving techniques with classmates in study groups, and group homework will be permitted. Evidence of academic dishonesty will be dealt with by University Policy 49-20, described at: http://www.psu.edu/ufs/policies/47-00.html#49-20. Unauthorized use of a solutions manual is a deliberately dishonest act. For additional University & College policies on academic integrity see http://www.psu.edu/ufs/policies and http://www.engr.psu.edu/CurrentStudents/acadinteg.asp.

Classroom Rules: We have a lot to learn this semester and the following classroom rules are in place to ensure respect for the learning experience of each member of the classroom:

1. Absolutely no cell phones should be used during class – this includes texting/messaging. Please remember to turn your phone off before class starts. Cell phone rings will result in a letter-grade deduction on the final exam or the requirement to bring lemonade/coffee for the entire class during the next class. Note: this class has **90** students.
2. Tardiness is disruptive – please make every attempt to be in class on time. If you are late, be considerate of your classmates as you enter the classroom and find a seat.
3. You will not be given extra time on a quiz or test if you are late for class.
4. Snacks and drinks are allowed, but please no full-course meals, it is distracting to the students and the instructor.

Homework Format:
In this class, work with up to 3 other individuals (4 total) is permitted. Everybody has to turn in a copy of the homework; if you work in a team, please mention your team member names on the first page of your homework.
All homework should be in the following format, unless it is an open-ended question, or trivial.

GIVEN: Include a sketch if possible.
ASSUMPTIONS: These need to be justified if they are atypical.
PROBLEM STATEMENT: What is unknown that we are asked to find.
SOLUTION: Solve the problem, step-by-step, and *always include units*. **Box the final answer.**
SANITY CHECK: Miscalculations can lead to unrealistic results. Indicate if you feel that your answer is not realistic!

Note: The most important thing to me is that the solution method is coherent and systematic. One of the major tools you should leave this course with is enhanced engineering problem solving methodology. Also, please turn in neat assignments – no torn pages, coffee stains, or smudges. If we can't read it, we won't grade it.

*Each of the homeworks will be due in class or it is 15% off on the same day. Any day after the due date, but before solutions are posted is 50% off. After solutions are posted, the homework is counted as a zero. Please tell me prior to class if you will not be in class the day a homework is due and we can arrange for an alternate method of submitting your work.

Quizzes:
There will be several quizzes and three exams during this course. The exams may be in-class or take-home in nature and will be announced in class.

Attendance:
Due to the nature of this course and the fact that the quiz and test material will be discussed in class, it is assumed that those who regularly attend lectures will do better; therefore attendance is very important.

Anticipated Class Lecture Schedule:

Lecture	Date	Topic
1	Aug. 26	Introduction to course
2	Aug. 28	Physical frameworks & introduction to conservation principles
3	Aug. 30	Key concepts and definitions **HW1 Due**
	Sept. 2	LABOR DAY – NO CLASS
4	Sept. 4	Key concepts and definitions
5	Sept. 6	Dimensions and units/problem solving methodology **QUIZ #1, HW2 Due**
6	Sept. 9	Motivation for study of properties, common thermodynamic properties
7	Sept. 11	Properties
8	Sept. 13	State relationships, Ideal gas law **HW3 Due**
9	Sept. 16	Calorific equation of state; P-v, T-v, u-T, h-T plots for ideal gases
10	Sept. 18	Non-ideal gases: Van der Waals EOS & generalized compressibility
11	Sept. 20	Multi-phase substances: phase boundaries, quality, T-v diagrams **QUIZ #2, HW4 Due**
12	Sept. 23	Multi-phase substances: phase boundaries, quality, T-v diagrams
13	Sept. 25	Compressed liquids and solids
14	Sept. 27	Conservation of mass: systems; flowrates & control volumes **HW5 Due**
15	Sept. 30	Energy storage, heat & work interactions at boundaries
16	Oct. 2	Identifying heat & work interactions
17	Oct. 4	Energy conservation for a system: finite processes **QUIZ #3, HW6 Due**
18	Oct. 7	Energy conservation for a system: at an instant
19	Oct. 9	Energy conservation for a system: examples & applications - Otto cycle
20	Oct. 11	Energy conservation for a control volume – introduction **HW7 Due**
21	Oct. 14	Single general 1st law for fixed-mass systems & control volumes
22	Oct. 16	Steady flow processes and devices
	Oct. 18	Exam 1
23	Oct. 21	Steady-flow devices: nozzles, diffusers, & throttles
24	Oct. 23	Steady- flow devices: pumps, compressors, fans, & turbines
25	Oct. 25	Steady-flow devices: heat exchangers **HW8 Due**
26	Oct. 28	Steam power plants & jet engines revisited
27	Oct. 30	2nd law of thermodynamics: Overview, Kelvin-Planck statement, consequences
28	Nov. 1	Carnot cycle & Carnot efficiency; definition of entropy

		HW9 Due
29	Nov. 4	Entropy-based statement of 2nd law, entropy balances, other 2nd-law statements
30	Nov. 6	2nd-law property relationships
31	Nov. 8	T-s relationships for ideal gases, air tables, isentropic relationships **QUIZ #4, HW10 Due**
32	Nov. 11	Isentropic & polytropic processes, T-s & P-v diagrams
33	Nov. 13	Isentropic efficiencies
	Nov. 15	Late Drop Deadline
34	Nov. 15	Steam power plant: Rankine cycle with superheat **HW11 Due**
35	Nov. 18	Rankine cycle with reheat & regeneration
36	Nov. 20	Vapor-compression refrigeration cycle
	Nov. 22	Exam 2
	Nov. 25-29	No class – Thanksgiving break
37	Dec. 2	Otto & Diesel air-standard cycles
38	Dec. 4	Jet engines: Turbojet engine cycle analysis
39	Dec. 6	Jet engines: Turbojet engine cycle analysis **QUIZ #5, HW12 Due**
40	Dec. 9	Gas-turbine engines: Brayton cycle
41	Dec. 11	Gas-turbine engines: Brayton cycle
42	Dec. 13	Exam 3

Reading material:
Week 1: Chapter 1.1 – 1.3
Week 2: Chapter 1.4, 1.11
Week 3: Chapter 1.5 – 1.10
Week 4: Chapter 3.1 – 3.4
Week 5: Chapter 3.5 – 3.8
Week 6: Chapter 2.1 – 2.8
Week 7: Chapter 4.1 – 4.5
Week 8: Chapter 5.1 – 5.3
Week 9: Chapter 5.4
Week 10: Chapter 6.1 – 6.11
Week 11: Chapter 7.1 – 7.6
Week 12: Chapter 7.6 – 7.9
Week 13: Chapter 10.2 – 10.5
Week 14: Chapter 9.3 – 9.7, 9.11
Week 15: Chapter 9.8 – 9.10

COURSE OBJECTIVES AND OUTCOMES

Course Objectives: (Mapping to Program Outcomes shown in brackets)

A. Appreciate the role of thermodynamics in engineering and society. [3c]

B. Understand the importance of thermodynamic properties and know how to use them. [2b]

C. Understand the First Law of Thermodynamics and know how to use it to solve engineering problems. [2b]

D. Understand the Second Law of Thermodynamics and know how to use it to solve engineering problems. [2b]

E. Apply the First and Second Laws to practical systems, including Rankine cycles, refrigeration cycles and gas cycles. [2e]

F. Develop fundamental engineering problem solving skills. [4d]

Course Outcomes: (Mapping to Course Objectives shown in brackets)

1. Obtain thermodynamic data necessary to solve thermodynamic problems and when necessary use appropriate approximations. These skills include the use of equations of state and/or tabulated property tables. [B]
2. Write the First Law of Thermodynamics in their appropriate forms for both closed system and control volume problem. [C]
3. Solve problems requiring First Law analysis that produce a simple single answer. [C]
4. Make appropriate assumptions when applying the First Law to a “real-world” problem. [C]
5. Write the Second Law of Thermodynamics in their appropriate forms for both closed system and control volume problem. [D]
6. Apply the Second Law to determine the performance limitations of a given thermodynamic system. [D]
7. Apply thermodynamic concepts to describe the performance of the individual components of an engineering system, e.g. a power plant, a jet engine, etc., and then relate that information to the overall performance of the entire system. [E]
8. Physically interpret and apply integrals and derivatives to solve thermodynamic problems. [F]
9. Translate complex word problems into an orderly and logical problem solving approach. [F]
10. Use software to solve thermodynamics problems. [F]

Program Outcomes: (Asterisks show outcomes that are assessed for Program Assessment)

2b. Analysis of thermal/fluids components**

2e. Analysis of thermal/fluids systems**

3c. Contemporary issues**

4d. Develop models and choose appropriate tools to implement, solve, and present those models

STATEMENT ON ACADEMIC INTEGRITY

It is a simple matter of personal integrity, but unfortunately there are a few out there that have no personal pride in their own work. Earning a C is far more satisfying than stealing an A. Academic honesty and integrity is of utmost importance. Detailed information on this topic can be found at www.engr.psu.edu/undergrad/acad_int/students. Some examples are given below:

CHEATING: Using crib sheet; pre-programming a calculator; using notes or books during a closed book exam etc.
COPYING ON TEST: Looking at another unsuspecting student's exam and copying; copying in a complicit manner with another student; exchanging color-coded exams for the purpose of copying; passing answers via notes; discussing answers in exam, etc.
PLAGIARISM: The fabrication of information and citations; submitting others work from professional journals, books, articles and papers; submission of other students papers or lab results or project reports and representing the work as one's own; fabricating in part or total, submissions and citing them falsely, etc.
ACTS OF AIDING OR ABEADING: Facilitating acts by others; unauthorized collaboration of work; permitting another to copy from exam; writing a paper for another; inappropriately collaborating on home assignment or exam without permission or when prohibited, etc.
UNAUTHORIZED POSSESSION: Of examinations, through purchase or supply; stealing exams; failing to return exams on file; selling exams; photocopying exams; buying exams; any possession of an exam without the custodian's permission, etc. You are NOT allowed access to the solution manual associated with the textbook.
SUBMITTING PREVIOUS WORK: Submitting a paper, case study, lab report or any assignment that had been submitted for credit in a prior class without the knowledge and permission of the instructor.
TAMPERING WITH WORK: Changing own or another students work product such as lab results, papers, or test answers; tampering with work either as a prank or in order to sabotage another work, etc.
GHOSTING: Taking a quiz, an exam, performing a laboratory exercise or similar evaluation in place of another; having another take a quiz, an exam, or perform an exercise or similar evaluation in place of the student, etc.
ALTERING EXAMS: When instructor returns graded exams for in class review and subsequently collects them, student changes incorrect answers and seeks favorable grade adjustment asserting that instructor made mistake in grading; other forms may include changing the letter or and/numerical grade on test; obtaining test in discretely, etc.
COMPUTER THEFT PROGRAM: Electronic theft of computer programs, data, or text belonging to another etc.

STATEMENT ON ACCOMODATIONS FOR STUDENTS WITH DISABILITIES

Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. The Office for Disability Services (ODS) Web site provides contact information for every Penn State campus: http://equity.psu.edu/ods/dcl. For further information, please visit the Office for Disability Services Web site: http://equity.psu.edu/ods.

In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: http://equity.psu.edu/ods/doc-guidelines. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. You must follow this process for every semester that you request accommodations.

STATEMENT ON COUNSELING & PSYCHOLOGICAL SERVICES (CAPS)

CAPS can help students resolve personal concerns that may interfere with their academic progress, social development, and satisfaction at Penn State. Some of the more common concerns include anxiety, depression, difficulties in relationships (friends, roommates, or family); sexual identity; lack of motivation or difficulty relaxing, concentrating or studying; eating disorders; sexual assault and sexual abuse recovery; and uncertainties about personal values and beliefs.

You can contact CAPS by calling the Main CAPS number/Appointment Scheduling: 814-863-0395 (Please call between the hours of 8am and 5pm, Monday-Friday to schedule an appointment) or visit us at our office location, 5th Floor Student Health Center.

Online Resources for Relaxation:
It's important to take care of yourself. There are a number of valuable online resources that you can use for relaxation and stress reduction.
Learn how stress impacts your health and life, as well as some self-help strategies for managing it through the PSU Student Affairs EDGE online workshop. Check out other stress management resources available, including a guided program called Stress Recess. There are also a number of relaxation, visualization, and mindfulness resources at the Mind Body Spa. You can also download mindfulness meditations here. If winter has got you down and you need an upbeat song to listen to, check this out.

Sexual Assault and Relationship Violence Hotline:
A hotline has been established for victims and observers of sexual assault and relationship violence. Trained counselors on the hotline will help students access appropriate resources. Penn State students from any campus can call 1 (800) 560-1637 to access the 24 hour a day, seven days a week hotline.