Sample Syllabus

ME 300 Engineering Thermodynamics
Spring 2021

Textbook:
Thermodynamics Concepts and Applications, Second edition, Cambridge University Press, by Stephen R. Turns and Laura L. Pauley, 2020.

Course URL:
Canvas (https://canvas.psu.edu): Lecture video links, homework problems/solutions, lecture notes, quizzes /solutions/grading rubrics are posted here.

Zoom (https://psu.zoom.us/j/93311815103?pwd=SU1rdW9iWHEwT3NmK3NYZ3NkMHBlQT09, Password: 000217): For the Friday synchronous online class and TA office hours on Thursdays.

Course Format:
On Mondays and Wednesdays (except the first week), download blank lecture notes, watch the video lectures (all available on Canvas), take notes and submit a pdf scan of your annotated notes the same day, before 11:59 PM. On Fridays, you will take biweekly quizzes (exams). For Fridays that you do not take exams, I will solve examples and hold real-time Q&A sessions. Homework assignments will be posted on Canvas after the Friday class.

Pre-requisites/Co-requisites: CHEM 110 and MATH 141

Class time and location: MWF 10:10AM - 11:00AM, Zoom (MW: lecture videos, F: Zoom)

Instructor: Dr. Sukwon Choi
Assistant Professor of Mechanical Engineering
E-mail sukwon.choi@psu.edu (preferred method for communication)
Office: 306 Reber Phone: (814) 863-4355

Teaching Assistants: Glenn Hatala (gwh12@psu.edu), Jibin Kolliyil (jmj6186@psu.edu)

Office Hours:
TA office hours (homework problems, quizzes):
Thursday 12:00-1:00 pm, location: Zoom
(https://psu.zoom.us/j/93311815103?pwd=SU1rdW9iWHEwT3NmK3NYZ3NkMHBlQT09, Password: 000217)

Instructor office hours (basic concepts, grading, sukwon.choi@psu.edu): Email the instructor with questions at any time. The instructor will answer your questions and set up a zoom meeting if necessary.

Exams:
Biweekly in-class quizzes on Fridays. No separate midterm and final exams. Refer to the "Class Lecture Schedule" below.

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

Grading: (Two lowest homework scores and one lowest quiz score will be dropped)

Homework (30-2):	40%
Quizzes (7-1):	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

Homework, Lecture Videos, & Lecture Notes:
Every Monday and Wednesday, I will upload blank lecture notes and recorded video lecture links on the Canvas website. Complete taking notes while watching the lecture videos. Then submit a pdf scan (use the "Assignments" tab in the Canvas website) the same day the lecture was given, by 11:59 pm. A one-day late submission is allowed but 30% of the total score will be deducted. Assignments submitted after this 24-hour grace period will be graded as zero.
Homework assignments including reading assignments and homework problems (with solutions) will be posted on Canvas. For the homework problems, working with your peers is permitted and encouraged. Use TA office hours to ask for help regarding these problems. All homework questions should be solved/practiced using the following format.

KNOWN: List properties, variables, etc. given in the problem.
FIND: What is unknown that we are asked to find.
SKETCH: Schematic diagram and relevant graphs (P-v, T-s diagrams, etc.).
ASSUMPTIONS: These need to be justified if they are atypical.
ANALYSIS: 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: No need to submit your work on the homework problems (solutions will be given to you upfront). Only submit a pdf scan of your annotated notes.

Exams/Quizzes:
You will be taking biweekly synchronous online exams. The exam will consist of two problems:
- One problem similar to your homework and/or class example problems.
- Another conceptual problem related to what was taught in the video lectures.

These will be closed book exams and will require you to be proctored via a ZOOM webcam. There will be no separate formal midterm or final exams. You must submit your exam worksheet before the zoom meeting closes at 11:00 am using the "Assignments" tab (submit your work, then leave the zoom meeting). Late submissions will be graded as a zero. Make-up exams will be only allowed for medical emergency cases, especially those related to the COVID-19 pandemic. Provision of the doctor's letter will be mandatory to submit make-up work.

Make-up Exams/Quizzes: No make-up exams or quizzes will be given except as required by University policy. See me ***prior*** to any anticipated absence, preferably at the beginning of the semester.

Contesting Grades: Grades must be appealed ***within one week*** after you receive your assignment score and after reviewing the grading rubrics posted on Canvas.

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. When you earn an Engineering degree from Penn State, the University is certifying that you are capable of performing engineering duties at a professional level. Course grades are the sole basis on which the College of Engineering certifies your degree with the assumption that your course grades are a valid assessment of your own knowledge and abilities. If you have cheated, you have falsified that credential. Therefore, we must have academic

integrity expectations to ensure the validity of your grade and your degree. It is encouraged, however, to discuss problems solving techniques with classmates in study groups and during office hours. Evidence of academic dishonesty will be dealt with by University Policy 49-20, described at: https://advising.engr.psu.edu/student-resources/academic-integrity.aspx. Unauthorized use of a solutions manual is a deliberately dishonest act. The instructor will follow sanctioning guidelines for all cases of violations of academic integrity, which can be found at https://undergrad.psu.edu/aappm/sanctioning-guidelines.html. ***Students who are found to be dishonest will be reported to the University's Office of Student Conduct for disciplinary sanctions.***

Classroom Rules:

- No references, especially web-browsing will be permitted during exams. For all exams, any form of violation of academic integrity will be directly reported to the University's Office of Student Conduct.
- Tardiness is disruptive – please make every attempt to be in class on time. If you are late for the in-class exams, you will not be given extra time.

Problem Format (homework, quizzes, exams):

All homework should be in the following format, unless it is an open-ended question, or trivial.

KNOWN: List properties, variables, etc. given in the problem.
FIND: What is unknown that we are asked to find.
SKETCH: Schematic diagram and relevant graphs (P-v, T-s diagrams, etc.).
ASSUMPTIONS: These need to be justified if they are atypical.
ANALYSIS: 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.

Attendance: Due to the nature of this course and the fact that the exam and test materials will be discussed in class, it is assumed that those who regularly attend lectures will do much better; therefore, attendance (watching lecture videos and attending the real-time sessions) is very important.

Anticipated Class Lecture Schedule:

Lecture	Date	Topic	Reading Material
1	Jan 20	Introduction to course	1.1, 1.2
2	Jan 22	Physical frameworks & introduction to thermodynamics	1.3, 1.4
3	Jan 25	Key concepts and definitions	1.5
4	Jan 27	Dimensions and units/problem solving methodology/mathematical skills	1.6-1.8
5	Jan 29	**Quiz 1**	
6	Feb 1	Motivation for study of properties, common thermodynamic properties	2.1, 2.2
7	Feb 3	Properties	2.2, 2.3
8	Feb 5	**Examples, Q&A session**	
9	Feb 8	State relationships	2.3
10	Feb 10	Calorific equation of state; P-v, T-v, u-T, h-T plots for ideal gases;	2.3, 2.4
11	Feb 12	**Quiz 2**	
12	Feb 15	Ideal gas law	2.5
13	Feb 17	Nonideal gases: Van der Waals equation of state & generalized compressibility	2.6
14	Feb 19	**Examples, Q&A session**	

15	Feb 22	Multi-phase substances: phase boundaries, quality, T-v diagrams, interpolation;	2.7a
16	Feb 24	Compressed liquids and solids	2.8, 2.9
17	Feb 26	**Quiz 3**	
18	Mar 1	Conservation of mass: system, flow rates & control volumes;	3.2, 3.3, 3.4a-b
19	Mar 3	Energy storage, heat & work interactions at boundaries	4.1, 4.2
20	Mar 5	**Examples, Q&A session**	
21	Mar 8	Identifying heat & work interactions	4.3
22	Mar 10	Energy conservation for a closed system;	5.1
23	Mar 12	**Quiz 4**	
24	Mar 15	Energy conservation for an open system with steady flow	5.2a
25	Mar 17	Energy conservation for a system: examples	5.3
26	Mar 19	**Examples, Q&A session**	
27	Mar 22	Energy conservation for a control volume / examples	5.3
28	Mar 24	Steady flow processes and devices	5.3, 8.1-8.3
29	Mar 26	**Quiz 5**	
30	Mar 29	Steady-flow devices: nozzles, diffusers & throttles	8.2-8.3
31	Mar 31	Steady-flow devices: pumps, compressors, fans & turbines;	8.4-8.5
32	Apr 2	**Examples, Q&A session**	
33	Apr 5	Steady-flow devices: heat exchangers;	8.6
	Apr 7	*Wellness Day - No Classes*	
34	Apr 9	2nd law of thermodynamics: Overview, Kelvin-Planck statement, consequences **(Late Drop Deadline)**	6.1-6.3a
35	Apr 12	Carnot cycle & Carnot efficiency; definition of entropy	6.3b-7.1
36	Apr 14	Entropy-based statement of 2nd law, entropy balances, other 2nd-law statements	7.2
37	Apr 16	**Quiz 6**	
38	Apr 19	2nd law property relationships	7.2b, 7.2c
39	Apr 21	T-s relationships for ideal gases, isentropic relationships	7.2c
40	Apr 23	**Examples, Q&A session**	
41	Apr 26	Isentropic & polytropic processes, T-s & P-v diagrams	7.4a-e
42	Apr 28	Isentropic efficiencies of turbines/pumps	7.5a-b
43	Apr 30	**Quiz 7**	

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.
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 Accommodations 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.