

## ME 400 Engineering Thermodynamics

Fall 2013

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**Class Time:** 10:00-10:50 AM, M,W,F

**Classroom:** ENGA-222

**Course Text:** Moran, M.J. and Shapiro, H.N., Fundamentals of Engineering Thermodynamics, 6<sup>th</sup> or 7<sup>th</sup> edition, John Wiley and Sons, 2008, or 2011.

**Course Objective:** The objective is to provide you (the students) with: (1) a qualitative and quantitative understanding of exergy, exergy destruction, and exergetic efficiency, (2) an in-depth analysis of the power cycles necessary for the design of transportation engines and stationary power plants, (3) methods to analyze the performance and operating conditions of vapor compression refrigeration cycles, and (4) methods to analyze combustion processes typically used in power cycles.

**Philosophy:** (1) Someone (you, your parents, or other individuals) has paid for you to learn advanced thermodynamics; you should demand a lot from this money that has been paid. I will try my best to teach you the material so that you are encouraged to learn the material.

(2) Your degree has great value when the degree represents that you have successfully learned the material prescribed by the department. In the long run if you have not learned the material it will result in a disadvantage to you and the companies that employ you eventually resulting in the company's and/or your downfall.

(3) The department chairman, dean, and chancellor of the university have indirectly asked me to recommend those students who know this material sufficiently well to receive passing grades. I take this responsibility very seriously. Therefore to receive a passing grade in this course you will need to receive greater than an average of 63% on the tests given and on the final exam.

### **Topics and Chapters Covered:**

- Exergy, exergetic efficiency, and exergy destruction (5 lectures)
- Advanced vapor power cycles (10 lectures)
- Gas power cycles (12 lectures)
- Ideal vapor compression cooling cycle, absorption cooling cycle, heat pump systems (10 lectures)
- Combustion and review for final exam (6 lectures)
- These topics are covered in Chapters 7-10, and 13 in the textbook.

**Homework:** Homework is due most Fridays of the semester. The homework assignment will at least be distributed the Monday before it is due. Homework is due when class begins but is not late until 4:00PM on the Friday it is due at my office. Assignments turned in up to one class period late receive a 20% deduction in score; homework turned in more than one class period late receives no credit. Units must be used throughout the problem and cancelled correctly; if not you will at least receive a one-point deduction even if you obtained the correct answer. The lowest homework assignment will be dropped.

Solving homework problems in groups of 2-3 is acceptable and encouraged if all students: (1) participate in the solving of all the homework problems, (2) understand the problems and how they were solved, and (3) wrote the homework themselves. Copying homework electronically or by hand is unethical, against university policy, and results in lower exam scores because those individuals do not understand the homework problems and material of the course. **The students who, eventually, can solve homework problems individually are able to solve these problems during quizzes and tests.**

Please follow guidelines in Section 1.7.3 “Methodology for Solving Thermodynamic Problems” when solving homework problems.

**Lab and Field Trip:** The course includes a field trip to a power plant and a lab that analyses a gas turbine cycle.

**Class Participation:** When you signed up for the class it is implied that you agreed to participate in class often. Participation is considered (1) attending class; (2) paying attention; (3) asking questions when you have them; (4) answering questions when you are asked. After three times of not participating you receive a 1% deduction until all 3% is gone. If there are more than 20 times with no class participation you should petition the university to withdraw for the semester because a serious issue must have arisen that does not allow you to fulfill your class participation commitment. Another advantage is there should be great advantage and additional learning that is gained during class time; if this is not the case please let me know.

**Quizzes:** A quiz will be given the class period following the homework and it will be one of the homework questions with one or two numbers changed. People who understand the homework by their own work or fully understand it by working in a group or with assistance from the TA or instructor should do well on the quizzes. To ensure they fully understand the homework after working with others the student should redo the problem or solve a similar problem on their own. The lowest quiz score will be dropped. You can use the equations from your book and the tables in the back of your book for the quizzes.

**Exams:** There will be 3 exams given during the semester and the final comprehensive exam at the end of the semester. The first question of each of the 3 exams during the semester will be exactly from the homework. Exams will be given after Chapters 7-8, 9, and 10; the exams will be given in class and will consist of approximately 3 problems to be completed in 50 minutes. The final exam will cover the material for the entire semester and will include problems from Chapter 13 which will not be tested during the semester.

There will be assigned seating during the exams and the exams must be completed with a calculator acceptable for use in the Fundamentals of Engineering (FE) exam. These calculators are all Casio fx-115 models, HP 33s and HP 35s, and all TI-30X and TI-36X models. In each exam you can bring one side of a one-half sheet of 8.5 by 11 inch paper that only has equations on it and what the variables mean in the equation and the final you are allowed to use four half sheets of paper with equations on it. The exams are closed book but you can use the thermodynamic tables at the back of your book.

Please give me as much advance notice as possible if there is a conflict with the exam. If there is an emergency that conflicts with the scheduled exam, a make-up exam will be given, I try to give a fair make-up exam however it is very difficult to write another exam that is the same difficulty as the first exam therefore, please make all efforts to attend the original exam.

**Grading Policy:**

Homework	3%
Quizzes (includes field trip letter and lab report)	14%
Exams during semester	50%
Final Exam	30%
Class participation	<u>3%</u>
	100%

**Emergency Procedures.** Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. Because some health and safety circumstances are beyond our control, we ask that you become familiar with the SIUC Emergency Response Plan and Building Emergency Response Team (BERT) program. Emergency response information is available on posters in buildings on campus, available on BERT's website at [www.bert.siu.edu](http://www.bert.siu.edu), Department of Safety's website [www.dps.siu.edu](http://www.dps.siu.edu) (disaster drop down) and in Emergency Response Guideline pamphlet. Know how to respond to each type of emergency. Instructors will provide guidance and direction to students in the classroom in the event of an emergency affecting your location. It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency. The Building Emergency Response Team will provide assistance to your instructor in evacuating the building or sheltering within the facility.

<b>Tentative Schedule for ME400, Fall 2013</b>				
<u>Date</u>	<u>Day</u>	<u>Lecture #</u>	<u>Material</u>	<u>HW Due or Quizzes Given</u>
19-Aug-13	M	1	7.1-7.2	
21-Aug-13	W	2	7.3 & Problem 7.24	
23-Aug-13	F	3	7.4-7.5 & Problem 7.55	HW #1
26-Aug-13	M	4	7.6	Quiz #1
28-Aug-13	W	5	More Exergy	
30-Aug-13	F	6	8.1-8.2.3	HW #2
2-Sep-13	M	Holiday	<i>Holiday</i>	
4-Sep-13	W	7	8.3	Quiz #2
6-Sep-13	F	8	8.4.1	HW #3
9-Sep-13	M	9	8.4.2	Quiz #3
11-Sep-13	W	10	8.5 (Binary Vapor Cycle) and closed feed water heater example problem	
13-Sep-13	F	11	8.5 (Cogeneration)	HW #4
16-Sep-13	M	12	Cogeneration example problem	Quiz #4
18-Sep-13	W	13	Field trip to Lake of Egypt Powerplant	
20-Sep-13	F	14	Review for Test 1	HW #5
23-Sep-13	M	15	<b>Test 1</b>	
25-Sep-13	W	16	9.1 - 9.2 (Otto Cycle)	
27-Sep-13	F	17	9.3 (Diesel Cycle) & Prob. 9.21	Thank you letter for power plant tour
30-Sep-13	M	18	9.5-9.6	
2-Oct-13	W	19	9.7	
4-Oct-13	F	20	Problem 9.49	HW #6
7-Oct-13	M	21	9.8.1-9.8.3	Quiz #5
9-Oct-13	W	22	Problem 9.75	
11-Oct-13	F	Holiday	<i>Holiday</i>	
14-Oct-13	M	23	9.9	HW #7
16-Oct-13	W	24	More Ch 9 things	Quiz #6
18-Oct-13	F	25	Jet engine laboratory	
21-Oct-13	M	26	Review for Test 2	HW #8
23-Oct-13	W	27	<b>Test 2</b>	
25-Oct-13	F	28	10.1-10.3	
28-Oct-13	M	29	Problem 10.6 and review Test 2	Jet engine laboratory report due
30-Oct-13	W	30	10.4.1-10.4.2	
1-Nov-13	F	31	Problem 10.28 and Section 10.5	HW #9
4-Nov-13	M	32	10.5 - 10.6	Quiz #7
6-Nov-13	W	33	Heat pump problem and 10.7	
8-Nov-13	F	34	10.7 and example problem from 10.7	HW #10
11-Nov-13	M	35	<i>Holiday</i>	
13-Nov-13	W	36	More Ch 10 or sample problem	Quiz #8
15-Nov-13	F	37	Review for Test	HW #11
18-Nov-13	M	38	<b>Test 3</b>	
20-Nov-13	W	39	13.1-13.2.1 Introducing combustion	
22-Nov-13	F	40	13.2.2 Control volumes at steady state	HW #12
25-Nov-13	M	41	13.2.2-13.2.3 Closed systems with combustion	Quiz #9
27-Nov-13	W		<i>Holiday</i>	
29-Nov-13	F		<i>Holiday</i>	
2-Dec-13	M	42	13.3 Adiabatic flame temperature	
4-Dec-13	W	43	EES example	
6-Dec-13	F	44	Review for final	HW #13
12-Dec-13	R		Final Exam 12:50 PM - 2:50 PM	