THE UNIVERSITY OF UTAH

ME EN 2300 Thermodynamics I
Department of Mechanical Engineering
University of Utah
Spring 2014

Instructor: Prof. Mathieu Francoeur
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Office Hours: M,W 2:00 pm – 3:30 pm or by appointment

Class Schedule: T,H
10:45 am – 11:35 am
WEB L103

Textbook: Y.A. Çengel and M.A. Boles, *Thermodynamics: An Engineering Approach*, 7th edition, McGraw-Hill, 2011 (ISBN: 978-0-07-352932-5).
*You also need the companion *Property Tables Booklet* for use during the exams.

Course Summary: Thermodynamics properties, open and closed systems, equations of state, heat and work, first law of thermodynamics, second law of thermodynamics and Carnot cycle.

Prerequisites: PHYS 2210: Physics for Scientists and Engineers I
MATH 1220: Calculus II

Grading:

Final Composite Score Based On:	
Mid-term exam 1	25%
Mid-term exam 2	25%
Final exam	40%
Homework	10%
	100%

Grading Scale:

93 – 100%:	A
90 – 92%:	A-
87 – 89%:	B+
83 – 86%:	B
80 – 82%:	B-
77 – 79%:	C+
73 – 76%:	C
70 – 72%:	C-
67 – 69%:	D+
63 – 66%:	D
60 – 62%:	D-
below 60%:	E

Final grading scale may be lowered by the instructor based on the overall class performance, but will not be raised.

Exams:

Two mid-term exams and a final exam are scheduled. The final exam will be comprehensive. The exams are closed book, closed notes. Only the *Property Tables Booklet* and cheat sheets provided by the instructor are allowed.
In the event of a missed exam, students will be required to provide a valid explanation for the conflict and will be required to complete a make-up exam. Please notify the instructor as soon as possible if you are unable to take an exam at the scheduled time.

Homework:

i) Homework problems from the textbook will be assigned on a weekly basis (see schedule for due dates).
ii) All homework assignments, consisting of about 5 to 7 problems each, will be equally weighted (20 points each). Submitting a complete solution to all problems, including the answer(s), ensures a minimum grade of 12 points out of 20. In a given homework assignment, only 1 problem (chosen by the instructor) will be formally graded, and will constitute the remaining 8 points.
iii) Homework will be collected in class on the due date listed in the schedule. Alternatively, homework may be placed in the class basket in the ME office (MEB 2110).
iv) Homework must be turned in by 5:00 pm on the assignment due date to avoid a late penalty.
v) Late homework will be accepted up to 1 day following the original due date. The late penalty is 10%. This penalty will be assessed unless there are extenuating circumstances (i.e., documented illness). On a homework due date immediately preceding an exam, no late homework will be accepted in order that solutions may be made available following the class.
vi) Homework solutions will be made available on the CANVAS course site 1 day after the original due date.

Class Policies:

i) All work submitted for grading should represent your individual effort. Since engineering is a group activity, students are highly encouraged to help each other to learn the course material and to discuss the homework assignments. However, all homework submitted must be each student's personal work. Students submitting work showing evidence of copying will receive zero credit.
ii) Submitting work copied from others will be considered academic misconduct. Plagiarism of ideas or work as well as giving or receiving unauthorized information on examinations will be considered academic misconduct. All academic misconduct will be dealt with severely and may result in a course grade of E.
iii) Laptop computers may only be used to take notes. The use of cell phones is strictly prohibited in the classroom.
iv) During the lectures, students are expected and encouraged to ask questions and participate in discussions. However, it may happen that some individuals have different points of view. While such an interactive and animated environment is usually beneficial from a learning standpoint, any disrespectful behavior toward the instructor or a classmate will not be tolerated. Any student showing such disrespectful behavior will be asked to leave the classroom.

Class Attendance: i) It is your decision whether or not to attend class.
ii) If you have a University athletic or academic activity or a business engagement, please contact the instructor before you leave to determine appropriate accommodations for the absence.
iii) If you are absent for any other reason, please contact your classmates for any pertinent material. Do not see the instructor for notes and handouts.

Class Website: i) A CANVAS course website has been established. Syllabus, PowerPoint presentations, homework assignments, homework solutions and other useful documentation will be posted at the course website.
ii) Electronic communication with all students will be made using a class email list compiled by the registrar. CANVAS email will not be supported. If your email address listed with the registrar is out of date, please update it by accessing the Campus Information System (CIS).

Course Objectives: At the end of this course, the student will be able to:

1. Demonstrate effective approaches to solving homework problems and the effective presentation of solutions.
2. Convert units between the United States Customary, SI and metric systems.
3. Define a thermodynamic system and its surroundings, intensive and extensive properties, equilibrium, heat, work, and state (point) and path functions.
4. Determine the single-phase and two-phase thermodynamic properties of common fluids (water and refrigerants) using thermodynamic property tables and charts.
5. Analyze and solve thermodynamics problems involving ideal gases with constant properties and with variable properties, including the use of the ideal gas tables when appropriate. Analyze and solve thermodynamics problems involving non-ideal gases, and incompressible fluids.
6. Solve steady and unsteady energy balance (First Law) problems for both open and closed systems.
7. Define reversible and irreversible processes and state what makes a process irreversible.
8. State the meaning of entropy, entropy generation, and the Second Law. Calculate the change in entropy of a system and its surroundings as it progresses from one state to another.

Homework Guidelines:
Points to keep in mind as you prepare your homework:

1. Use brief comments to make your thinking clear, to connect parts of the problem, and to indicate where data and equations were obtained.
2. Be sure units are correct, consistent, and clearly stated.
3. Clearly identify the answer (box, arrow, etc.)
4. Use only one side of the paper.
5. If more than 1 problem is on a page, separate with a double line.
6. Number pages in lower right hand corner.
7. Staple at upper left hand corner.

Americans with Disabilities Act of 1990:
The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.

ME EN 2300 – Thermodynamics I
Spring 2014 Schedule

Week	Class #	Date	Day	Topics	Sections to read in the book	HW due dates
1	1	Jan. 7	T	Introduction, Units, Systems	1.1-1.3	
	2	Jan. 9	H	Properties, States, Processes, Pressure	1.4 – 1.12	
2	3	Jan. 14	T	Energy, Heat, Work	2.1 – 2.4	
	4	Jan. 16	H	Mechanical Forms of Work, First Law	2.5, 2.6	1
3	5	Jan. 21	T	First Law, Energy Conversion Efficiencies	2.7, 2.8	
	6	Jan. 23	H	Pure Substances, Phases, Phase Change	3.1-3.4	2
4	7	Jan. 28	T	Property Tables	3.5	
	8	Jan. 30	H	Equations of State, Other Properties	3.6-3.8	3
5	9	Feb. 4	T	*Review for Mid-Term Exam 1*		
	10	Feb. 6	H	**Mid-Term Exam 1 (Chapters 1 to 3)**		
6	11	Feb. 11	T	Boundary Work, First Law for Closed Systems	4.1, 4.2	
	12	Feb. 13	H	Specific Heat, Ideal Gas Properties	4.3, 4.4	4
7	13	Feb. 18	T	Solid and Liquid Properties	4.5	
	14	Feb. 20	H	Conservation of Mass, Flow Work	5.1, 5.2	5
8	15	Feb. 25	T	First Law for Steady-Flow Systems and Steady-Flow Devices	5.3, 5.4	
	16	Feb. 27	H	Steady Flow Devices	5.4	6
9	17	Mar. 4	T	Steady Flow Devices and Unsteady-Flow Processes	5.4, 5.5	
	18	Mar. 6	H	Second Law, Thermal Reservoirs, Heat Engines	6.1 – 6.3	7
10		Mar. 11	T	**Spring Break**		
		Mar. 13	H	**Spring Break**		
11	19	Mar. 18	T	*Review for Mid-Term Exam 2*		
	20	Mar. 20	H	**Mid-Term Exam 2 (Chapters 4 and 5)**		
12	21	Mar. 25	T	Refrigerators, Reversible and Irreversible Processes	6.4 – 6.6	
	22	Mar. 27	H	Carnot Cycle, Carnot Devices	6.7 – 6.11	8
13	23	Apr. 1	T	Entropy, Entropy Changes, Isentropic Processes	7.1 – 7.4	
	24	Apr. 3	H	*Tds* Relations, Δs Liquids, Solids	7.5 – 7.8	9
14	25	Apr. 8	T	*Tds* Relations, Δs for Ideal Gases	7.9	
	26	Apr. 10	H	Reversible Steady-Flow Work, Compressors	7.10, 7.11	10
15	27	Apr. 15	T	Isentropic Efficiencies	7.12	
	28	Apr. 17	H	Entropy Balances	7.13	11
16	29	Apr. 22	T	Entropy Balances	7.13	
	30	Apr. 24	H	*Review for Final Exam*		12*
17		Apr. 30	W	**Final Exam**	**10:30 am – 12:30 pm**	

*** no late homework accepted**