AME 310
Engineering Thermodynamics I
Fall 2016
ZHS 163 (Tu/Th 12:30-1:50pm)

Instructor: Julian A. Domaradzki
Aerospace and Mechanical Engineering
Office: RRB 203
Phone: 213-740-5357
E-*mail*: jad@usc.edu
Office Hours: M 1:00 – 3:00 and by email appointment

Teaching Assistant: Feng Ling
E-mail: fling@usc.edu
Office Hours*:* W 12:00 -2:00, Th 10:00 – 11:00, in VHE 202
and by email appointment
Discussion session: 5:00 – 5:50 pm, SAL 101, Wednesday

***Required Textbook*:** C. Borgnakke and S. E. Sonntag, *Fundamentals of Thermodynamics*. Either **8th edition** (Wiley, 2013) or **7th edition** (Wiley, 2009) can be used.

Grading:	Midterm	30%
	Final	40%
	Weekly Quizzes (10 best of 12)	30%

Examinations:	Midterm:	October 13 (Chapters 1-4).
	Final:	Dec 13 (cumulative with focus on Chapters 5-7).
	Quizzes:	Each Thursday (except week 1); material covered from Hw assigned previous week.

Remarks:

1. Homework assignments will be given every **Thursday**. Homework will not be graded but homework problems will be used in weekly exams/quizzes the following Thursday. Homework and Quizzes solutions will be available after each Thursday class. If you would like to receive feedback on your homework solutions they must be turned in before the quiz.
2. All examinations will be open book and a calculator ONLY. Homework and other written materials will not be allowed.
3. Is it on the test? The purpose of AME 310 is to acquaint you with the basic principles of Thermodynamics, not only for its intrinsic merit, but also to acquaint you, as future professionals, with one of the fundamental pillars of modern engineering. There is much to

this field that cannot be covered in the lectures of any single course (including this one) and, conversely, you may not encounter many things that will be discussed in class ever again (even on exams).

4. The best way to do well in this course is to keep up with all aspects of the class (e.g., attending lectures, doing the homework on time, participating in class discussions, etc.). That being said, I do not take attendance and, as you can see from the grading policy above, it is possible to receive an A in this course without doing any homework at all. I do not recommend such an approach since the best way to succeed in this class is practice, practice, practice.

This course is intended to:

- Teach students basic principles of classical thermodynamics.
- Train students to identify, formulate and solve engineering problems in classical thermodynamics involving both closed and open systems under either steady state or transient conditions.
- Teach students how to apply both 1st and 2nd Law analysis methods to thermodynamic systems.

Class Schedule:

Wk	Date	Lecture Topics	
1	Aug 23	Syllabus. Ch. 1: Thermodynamic systems, state, and properties (pressure, density, temperature).	
	Aug 25	Ch. 1: Thermodynamic equilibrium, processes, and cycles; systems of units.	
2	Aug 30	Ch. 2: Pure substance; phase transitions and phase diagrams; saturated water/vapor; quality.	
	Sept 1	Ch. 2: Independent thermodynamic properties; plots and tables of properties; examples of use.	
3	Sep 6	Ch. 2: P-v-T diagram; equation of state; ideal gas; compressibility factor.	
	Sep 8	Ch. 2: Examples of using the equation of state and the compressibility chart.	
4	Sep 13	Ch. 3: 1st law of thermodynamics. Mechanical work; boundary work in compressible system.	
	Sept 15	Ch. 3: Polytropic processes; examples of computing work; other expressions for work.	
5	Sep 20	Ch. 3: Definition of heat; comparison of work and heat; heat transfer modes; examples.	
	Sep 22	Ch. 3: Internal energy and enthalpy; examples.	
6	Sep 27	Ch. 3: Specific heats for solids, liquids, and gases.	
	Sept 29	Ch. 3: Examples of calculations of enthalpy and energy for ideal gases. 1st law as a rate eq.	
7	Oct 4	Ch. 4: The 1st law for C.V.; mass, energy, enthalpy flow. Steady state process.	

	Oct 6	Ch. 4: Steady state process applications: heat exchanger, nozzle, throttle, turbine, compressor. Transient processes.	
8	Oct 11	Ch. 5: 2nd law vs. 1st law; heat engine, refrigerator, AC, heat pump; thermal efficiency.	
	Oct 13	Midterm exam.	
9	Oct 18	Ch. 5: Clausius and Kelvin-Planck formulations of 2nd law; reversible and irreversible processes. Carnot cycle.	
	Oct 20	Ch. 5: Efficiency of reversible/irreversible cycles; Carnot propositions; thermodynamic temperature scale and absolute temperature.	
10	Oct 25	Ch. 5: Heat engines and heat pumps. Ideal vs. real efficiencies.	
	Oct 27	Ch. 6: The inequality of Clausius. Steam power plant.	
11	Nov 1	Ch. 6: Definition of entropy. Computation of entropy for reversible processes.	
	Nov 3	Ch. 6: Gibbs' relations. Calculating entropy changes for incompressible solid/liquid.	
12	Nov 8	Ch. 6: Entropy changes for compressible gases (ideal gas). Polytropic processes.	
	Nov 10	Ch. 6: Entropy generation for a system.	
13	Nov 15	Ch. 6: Principle of the increase of entropy. Net entropy generation (system+surroundings). The entropy rate equation for control mass.	
	Nov 17	Ch. 7: The 2nd law for a control volume. Steady state processes. Reversible steady state processes.	
	Nov 22 Nov 24	Thanksgiving week	
14	Nov 29	Ch. 7: Transient processes.	
	Dec 1	Ch. 7: Principle of the increase of entropy. Efficiency.	
	Dec 13 (Tu) 11-1 p.m.	Final Exam	

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu or to the *Department of Public Safety* http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information http://emergency.usc.edu* will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

Page last updated: August 22, 2016.

The contents of this web page are subject to change. Weekly information will be updated without notice. Change in policies, important dates, and project content will be announced in class.