ME 4500 Energy Systems Analysis and Design
Course Policies and Syllabus

Instructor: Professor Peng Zhao, Ph.D.
330 EC
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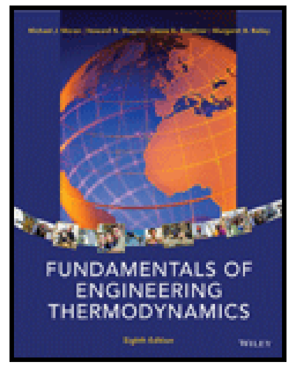
Class Times: T/Th, 8:00 - 9:47 am, MSC 172

Office Hours: 10 – 11 am on Thursdays at EC330, or by email (available most of the time)

Course Web Site: https://moodle.oakland.edu/moodle/login/index.php

Grader/TA: Jing Xu (jxu2@oakland.edu)¸ Office hour 1-2 pm on Mondays and Wednesdays at the graduate assistant office (4th floor, EC, right by the elevator)



Text: *Fundamental of Engineering Thermodynamics*, M.J. Moran and H.N. Shapiro, Wiley 8^{th} Ed. (Hardcopy)

Course Overview: This is a senior-level mechanical engineering course which is designed to further your understanding of basic thermodynamic principles and to extend your ability to design and analyze thermal/energy systems. The course includes weekly homework, three exams and a team design/analysis project.

Course Prerequisites: This course requires as a prerequisite an introductory course in thermodynamics, mainly EGR 250 (now EGR2500).

Course Objectives: By the end of the course, students should be able to aply the 1^{st} and 2^{nd} Laws of Thermodynamics to design and analyze thermodyamic systems. Specifically, the successful student should be able to:

- Apply the 1st and 2nd Laws of Thermodynamics in the analysis and/or design of power cycles such as the Rankine, Otto, Diesel and Brayton cycles. (a, c, d, e, f, g, i, j, k)
- Apply the 1st and 2nd Laws of Thermodynamics in the analysis and/or design of thermodyamic systems involving simple non-reacting mixtures and air-water vapor mixtures (psychrometry). (a, c, d, e, f, g, i, j, k)
- Apply the 1st and 2nd Laws of Thermodynamics in the analysis of simple systems involving reacting mixtures; determine heating values, adiabatic flame temperature and entropy produced during a chemical reaction (a, c, d, e,).

- Apply Exergy concepts in the analysis of simple thermal systems and devices; calculate maximum possible work, exergy destroyed. (a, e, k)

Course Grade :		
	Homework	6 % (Essential)
	Class participation	2 % (in-class + moodle activity)
	Design Project (*1)	20 % (teamwork + peer review)
	Tests (*4)	72 % (18%*4)
	Total:	100 %

Approximate Course Calendar: (Exam dates may be adjusted.)

Week of:	**Topic:**	**Reading**
Jan 4	Review: First Law, Properties of pure substances	Chapters 1-4
Jan 11	Review: Second Law, Property Relationships	5, 6
Jan 18	2nd Law Examples; Power Cycles: Rankine Cycle	8.1-8.5
Jan 25	Rankine Cycle examples (Jan 25, Test # 1)	8.1-8.5
Feb 1	Brayton Cycle;	9.5-9.9
Feb 8	Otto and Diesel Cycles;	9.1-9.4 & notes
Feb 15	Other Power Cycles; Ideal, Non-Reacting Mixtures (Design Project Assigned) (Feb 27, Test #2)	9.11; Notes; 12.1-12.4
Mar 1	Ideal, Non-Reacting Mixtures;	12.5-12.9
Mar 8	Psychrometry and chart;	12.5-12.9
Mar 15	HAVC systems and first law analysis; (Mar 20, Test #3)	
Mar 22	Reacting Mixtures: Reaction equation and Stoichometry	13.1-13.4
Mar 29	First Law Analysis of Reacting Mixtures;	
Apr 5	Second Law Analysis of Reacting Mixtures	13.5
Apr 12	Exergy; Control Volume Exergy Analysis and Applications	7.1-7.8, 8.6
Apr 17	Project presentation and Review	
Apr 24	*Apr 24, Test #4 (Final)* ***8:00 – 11:00am***	

Note: Class attendence is **mandatory**

<u>Important Dates</u>: (http://www.oakland.edu/important-dates)

- ✓ Jan 15 – MLK day
- ✓ Jan 17 - Last day for 100% tuition refund /add/declare audit/“no-grade” drop
- ✓ Feb 17- Feb 25, Winter recess
- ✓ Mar 14 - Last day for official withdrawal (W)
- ✓ Apr 17 - Last class for ME 4500
- ✓ Apr 24 – Final Exam (Test #4)

Course Description: This course builds upon your introductory course in Thermodynamics, but focuses more on applications rather than fundamental principles. In your first course, you studied fundamental principles such as *Conservation of Mass*, *Conservation of Energy*, and the *Second Law of Thermodynamics*. You also learned basic thermodynamic property relationships. This course will use all of those principles and property relationships as tools to study thermodynamic cycles, the thermodynamics of mixtures, especially air-water vapor mixtures, and thermochemistry, all of which form the foundations for thermal system design. There will also be some group design projects, in which you will apply the concepts learned.

Some Course Policies

Homework: It is not possible to do well in this course without working through, and sometimes struggling through, the homework. There is no substitution for the learning that comes with practice. In addition, the skills learned by working through problems on your own will translate to efficient problem solving during testing. Problems will be assigned each week. Homework will be collected and spot graded. Homework solutions will be made available to students on moodle. Assignments will be collected *within the first 5 mins of class* on the due date. Please use any neat 8 ½× 11 paper, clearly written or typed on one side. The completed assignment should be stapled together. *Please make a copy of all assignments before submission*. Solutions will be posted, and **no late homework will be accepted**. Help is available before and after due dates.
You may find it helpful to work with others on homework assignments. However, each student is expected to submit work that represents his/her own efforts. If you received assistant with an assignment, you must clearly indicate the names of others (or sources) who provided assistance, on the front page of your assignment.

Copying homework and solution manual is NOT allowed. If any kind of copying behavior is found, zero points will be given for the homework and the assignment will be submitted to the Academic Conduct Committee for possible further action.

Tests: All in-class tests will be *CLOSED-BOOK*, *CLOSED NOTES*. Only regular calculators will be allowed, **no wireless devices or tablets** (cell phones, ipad, etc.). ***No credit or make-up will be given for a test that is missed without prior instructor approval (72 hours in advance) or a certified medical excuse or serious emergency***. Specific dates of tests and guidance files for preparation shall be provided in advance of each test.

Design Project

There will be one group design project assigned mid-semester (groups of 4 students). A well-defined topic with good flexibility will be assigned to design a real world application for internal combustion engines, gas turbines or HVAC systems. Selected groups will present their results at the end of the semester on the last day of class and each team member shall be evaluated by by his/her partner for individual contributions.

Academic Conduct: All students are expected to read, understand, and comply with the *Academic Conduct Policy* found in the *Oakland University Undergraduate Catalog*. and the *Code of Student Conduct*. The policy applies to testing, homework and laboratory work, and is taken very seriously by the instructor. Perceived violations of this policy will be taken before the OU Academic Conduct Committee. Engineering is a profession that serves the public and demands integrity within its membership.

Course Web Site: The ***Moodle*** (*https://moodle.oakland.edu/moodle/login/index.php*) course manager will be used to disseminate course policies, schedules, course handouts, homework assignments and solutions, last-minute changes, and other course-related information. Students should check this site regularly. Any emails from the instructor will be sent to your official OU email address only.

Special Considerations:

Students who may require special considerations should work with Disabilities Support Services and the instructor to arrange accommodation.

***Please note that the use of cell phones, text messaging, tablets and laptops is not allowed in this class unless you receive special permission from the instructor.**

Program Outcomes: ABET (a-k)

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environ., social, political, ethical, health, safety manufactured ability, sustainability
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global economical, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice