Thermodynamics Applications
(ME 416)
Milwaukee School of Engineering
Fall 2017

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Office hours: To be determined (with your input) during week 1.
Office location: S-146 (NE corner of Science Building)
Required textbook: Thermodynamics: An Engineering Approach, 8th Edition, by Cengel & Boles, McGraw Hill. Text has an online learning center at http://www.mhhe.com/cengel-boles

Prerequisites: ME 314, ME 318, CH 200

Course Description: This course is a continuation of the mechanical engineering thermodynamic sequence, with emphasis on applications of thermodynamic principles to engineering systems. New topics include gas mixtures, engine power cycles, and combustion. Design projects and laboratory experiments are used to illustrate the application of thermal-fluid analysis to systems and devices such as vapor compression refrigeration, internal combustion engines, cogeneration systems, fuel cells and solar energy systems.

Related Program Student Learning Outcomes:

This course includes activities and work that will focus on the following learning outcomes:

The student will:

- have an ability to apply knowledge of math, engineering, and science.
- have an ability to design and conduct experiments, and to analyze and interpret data.
- have an ability to design a system, component or process to meet needs within realistic constraints.
- have an ability to identify, formulate, and solve mechanical engineering problems.
- have an ability to communicate effectively.

- have the broad education necessary to understand the impact of engineering solutions in a global and societal context.
- The student will develop knowledge of contemporary issues.
- The student will develop ability to use techniques, skills, and tools in engineering practice.
- have the ability to work professionally in the thermal systems area.

Course Outcomes:
Course Learning Outcomes

Upon successful completion of this course, the student will be able to:

• analyze Otto, Diesel, Dual, and other gas power cycles

• perform 1st Law analysis of combustion processes

• perform basic integrated thermal systems design

• apply 1st (and 2nd law) to real systems

• demonstrate the principles of thermodynamics and heat transfer in laboratory experimentation. Experiments may include the analysis of: power cycles and refrigeration cycles, solar photovoltaic systems, solar thermal systems, and cogeneration systems.

Methods of Assessing Student Learning Outcomes: quizzes, homework, lab reports, design projects/exercises, in-class exam, and a final exam

Letter Grades (This is a rough guideline. Grade determination will be discussed further in class.)

Letter Grade	% Equivalent
A	93-100
AB	87-93
B	80-87
BC	75-80
C	70-75
CD	65-70
D	60-65
F	0-60

Grade Calculation	
In-class exam	25 %
Project, labs, homework, quizzes	40 %
Final Exam	35 %

Homework:
Short homework assignments will be collected ***on occasion*** and suggested problems will be given over the course of the quarter. It is extremely important that students are able to solve all homework and suggested problems in preparation for the quizzes and exams.

In-Class Exam:
Exams and quizzes will be closed book/closed notes/closed laptop. You will be allowed one side of an 8.5"x11" sheet of paper for formulas and notes. Calculators are allowed.

A Note Regarding Exam Problems:
ALWAYS circle your answers and ALWAYS express them in the appropriate units! In general, be careful about units and always include them in the answer. Generous partial credit will be given whenever possible so attempt all problems.

Final Exam:
The final exam will be comprehensive. You will be allowed 2 sides of an 8.5"x11" sheet of paper for formulas and notes. The final exam consists of a 1 hour exam common to all ME 416 sections (on the material aligned with the textbook) and a 1 hour exam that is aligned with the course coverage in Dr. Damm's section (e.g. it may contain material that is not covered by other instructors). The two exams carry equal weight (17.5% each).

Use of Engineering Simulation Tools: Students are encouraged to utilize engineering equation solver software (EES) for solving problems that would otherwise require time-consuming use of property tables.

Attendance, Participation and Class Decorum:
Students are expected to attend lectures regularly and to participate fully in class discussions. Attendance in class is to your advantage. I will not take attendance & you will not be penalized for missing class, but certain important material and examples given here will **not** be in the textbook. Your level of effort will be used to determine borderline grades. Attendance is a factor in gauging your level of effort. **I will not drop students from the class for not attending.** If you desire to drop the course, you must do so with the university registrar.

Attendance is required at the lab sessions and students must submit the required materials for each lab (report, presentation, or other specified assignment).

Regarding Collaboration and Academic Honesty:
You may discuss labs and projects with the professor and with other students in the class, but you **must** do and submit your own work. You **must** write up your labs **independently,** unless you are specifically directed to write up the lab in a group. You may not examine the finished written work of other students, including those of a previous class. You are expected to conform to the MSOE code for academic honesty. Violation of this policy will result in ***grades of zero*** on the corresponding exam and/or assignment. Thus the result may be an ***F for the course***. Per MSOE policy, you cannot drop the course to avoid the grade penalty for cheating. Further, cheating students will be reported to the Department Head and the VP of Academics. If you cheat you risk ***expulsion*** from MSOE.

Examples of cheating:

-copying lab reports from another student
-copying lab solutions from a website
-copying from another student on an exam
-permitting another student to copy from you on an exam, homework assignment, or lab report
-copying lab reports from previous terms
-copying lab solutions from a solutions manual or from previously distributed solutions
-copying a lab solutions from a student who is solving the problem for others in a group setting

Bottom line--Any time you represent the work of others as your own you are cheating.

Late Work, Missed Exams:
Labs are due at the beginning of the lab period on the due date. Late assignments will not be accepted for credit or graded. A student will receive a zero on exams that are missed without a legitimate excuse (e.g. documented illness, family situation, etc.).

Tentative Schedule (note: the lab schedule, in particular, may vary from this tentative schedule)

Week 1	Course Overview, Thermo. I/II Review Start Chapter 9: Otto and Diesel Cycles	Lab: Overview and Safety Training
Week 2	Chapter 9: Otto and Diesel Cycles	Experimental uncertainty lab exercise (Lab 1)
Week 3	Chapter 9: Otto and Diesel Cycles	Lab 1 due Lab 2: IC Engines part 1
Week 4	Ch. 13: Gas Mixtures Chapter 15: Chemical Reactions (combustion)	CFR small group experiment
Week 5	15: Chemical Reactions (combustion)	Lab 2 Due Lab : Engine Design exercise
Week 6	15: Chemical Reactions (combustion)	Lab: Design of Experiment for Lab 3
Week 7	Advanced Topics in Thermodynamics	Lab 3: Cogeneration System Performance
Week 8	Renewable Energy Systems	Lab 3 due Lab 4: Solar Thermal System Performance
Week 9	Various topics and catch-up if required	No Lab, Lab 4 due
Week 10	Wrap-up and review	Lab 5: Solar PV System performance or other exercise
Final Exam Date to be determined		

- A comment/suggestion envelope is posted on my office door. Please let me know what you think about the course. I would particularly like to know how you feel about the pace of the course (too fast, too slow, or about right).

Student Accessibility Services (SAS)

- For students with documented disabilities, chronic medication conditions and mental health concerns; MSOE provides services to make reasonable accommodations available. If you are a student who requires or anticipates the need for accommodations, please contact Student Accessibility Services Office at 414-277-7281, by email at moureau@msoe.edu, or in person at K250 to discuss appropriate accommodations and eligibility requirements.