



THERMODYNAMICS – AE 209

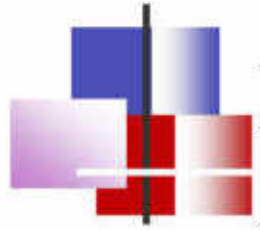
CHAPTER 0

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Course Objectives and Syllabus

by

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Instructor



Emre Kara, Ph.D.

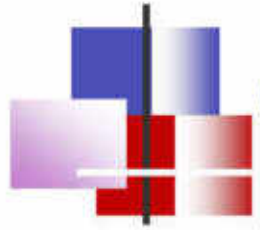
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Lecture webpage:

<http://www1.gantep.edu.tr/~emrekara/index.php/ae209/>





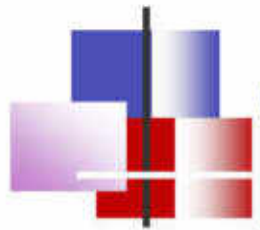
Course Information



Class Hours: Mon – 08:30-10:10 & Tues – 15:20-17:00

Location: A03

Number of Credit Hours: 4 hr credit



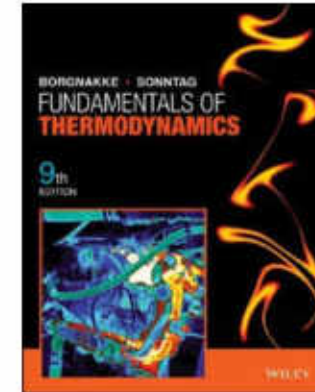
Compulsory Texts



1. Fundamentals of Thermodynamics

Borgnakke, Claus; Sonntag, Richard E.
John Wiley & Sons, Inc., 2002 or newer

(Superior exercises and problems)



2. Thermodynamics, an Engineering Approach Cengel, Y.A.

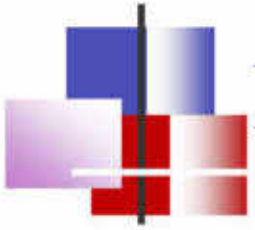
McGraw-Hill, 2006 or newer

(Superior expressions and easier to understand)



3. Buy Aksel Öztürk's Free Thermodynamics Property Table from Bookstore or Download Free Thermodynamics Property Table (Y. Çengel) from the following link:

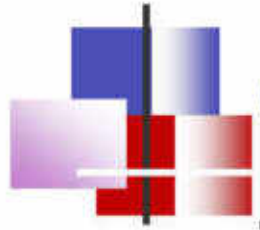
http://highered.mheducation.com/sites/dl/free/0073398179/1042936/Appendix1_SIunits.pdf



Recommended Texts



- Fundamentals of Engineering Thermodynamics, 8th ed. Moran, Michael J.; Shapiro, Howard N.; Boettner, Daisie D; Bailey, Margaret B. WILEY, 2014
- Thermodynamics and Chemistry, 2nd ed., Version 4 Howard DeVoe, 2012 Available online free by the author at:
<http://www2.chem.umd.edu/thermobook/downloads.htm>
- Thermodynamics: An Interactive Approach with Mastering Engineering, Global Edition Subrata Bhattacharjee, Pearson, 2015
- Thermodynamics for Engineers, 2nd Ed., Wong, K. V., CRC Press, 2011

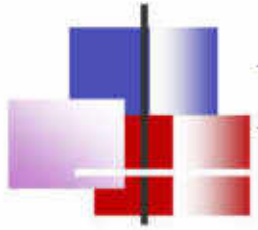


Course Objectives



This course deals with the fundamentals of Thermodynamics including:

- thermodynamic systems and properties,
- relationships among the thermo-physical properties,
- the laws of thermodynamics and
- applications of these basic laws in thermodynamic systems.

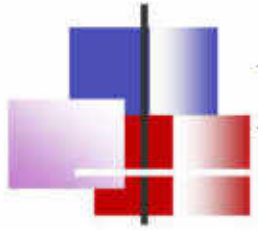


Expected Learning Outcomes



After successful completion of this course the students will be able to:

1. Explain fundamental concepts relevant to thermodynamics.
2. Explain the concepts of work, power, and heat in thermodynamics; determine work and heat sign conventions; determine work involved with moving boundary systems (graphical and analytical methods).
3. Explain the first law of thermodynamics for a closed system.
4. Perform energy analysis of refrigeration and heat pump thermodynamic cycles.
5. Determine thermodynamic properties of pure substances.

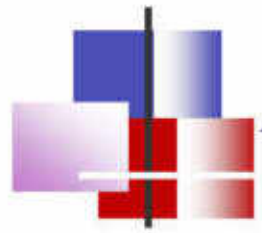


Expected Learning Outcomes



After successful completion of this course the students will be able to:

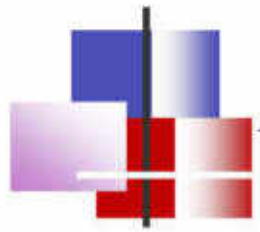
6. Apply the first law of thermodynamics for a control volume, including with turbines, compressors, nozzles, diffusers, heat exchangers, and throttling devices.
7. Explain the second law of thermodynamics, including why it is necessary, how it is defined (Kelvin-Planck and Clausius), the nature of irreversibility, and the Carnot cycle.
8. Explain the concept of entropy, including the Clausius Inequality, using thermodynamic tables, setting up entropy balances, and calculating isentropic efficiency of pumps, compressors, turbines, and heat exchangers.



Assessment (LOOK OUT !)



- Homeworks
- Quizzes
- Attendance
- Examinations
- Final Grades



Assessment (LOOK OUT !)



- Homeworks:

In order to encourage you to closely follow the material covered in the lectures and provide you with opportunities to practice the concepts taught in the class through problem solving, some problems will be assigned as homework assignments; some in the form of handouts or continuation of the class examples.

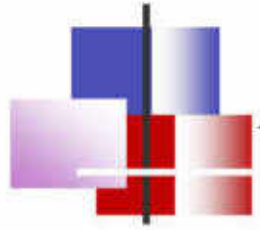
It is strongly recommended that the assignments are completed independently.

All assignments are due the next session unless another due date is announced by the instructor.

The assignments will be collected, graded, and returned as soon as possible, particularly before the tests.

Half the homework points will be given for each problem seriously attempted; the other half will be based on successful solution of the problem.

Late homework will be accepted with 20% penalty per day unless there is a legitimate excuse.



Assessment (LOOK OUT !)



- **Homeworks:**

The purpose of homework in this course is also to develop skills in clearly, logically, and completely communicating problem-solving methodologies.

Therefore:

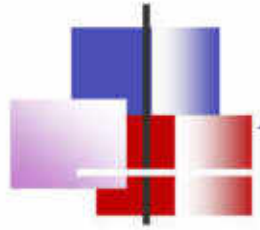
Each problem must have sections: “Given,” “Find,” “Assumptions,” and “Solution.” Sketches must be employed to illustrate the system in question, whenever the spatial relationships of quantities are not obvious.

The units must be clear for every numeric value. Real values must have at least three significant digits for intermediate results to avoid excessive error accumulation due to truncation. Final answers must have significant digits that reflect the known precision of the solution.

All computations must first show equations symbolically and then with numeric values, without any rearrangement of variables.

Submitted work must be neat. Use a ruler and compass for diagrams; underline or put boxes around answers.

Convince me you have the correct answer!

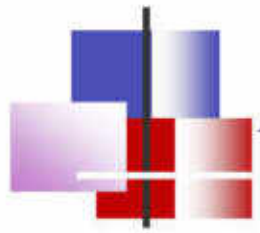


Assessment (LOOK OUT !)



- Quizzes:

Announced or **unannounced** quizzes may be given whenever it is found necessary.



Assessment (LOOK OUT !)

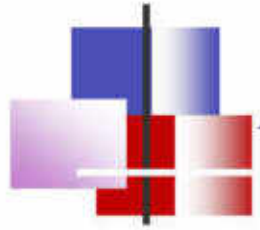


- Attendance:

Regular attendance is **strictly required (at least 70 %)**.

In case you have to miss a class, **you are responsible for keeping up** with the class work and being informed of all announcements made in the class concerning homework, quizzes, tests, etc.

If you encounter difficulties of any kind, feel free to come and see me in my office.



Assessment (LOOK OUT !)

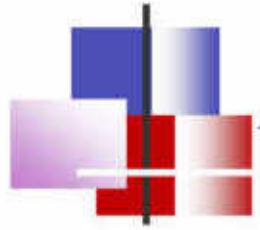


- Examinations:

Two term tests are scheduled. A final comprehensive examination will be given according to the school schedules based on the same format as the term tests.

They will consist of a section on concepts, definitions, and short exercises plus section with numerical problems. **Both will be closed-book, closed-notes and open-thermodynamics-table-book** (preferably from either **Y. Çengel's Thermodynamics Book table** or **Aksel Öztürk's table**. You can have them from any bookstores or as a 2nd hand from higher class students).

Make-up exams may be given for legitimate excuses if you contact the instructor as soon as you return to the school.



Assessment (LOOK OUT !)



- Final Grades:

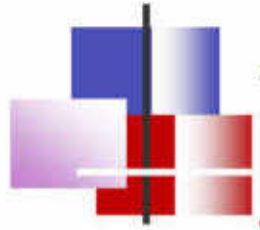
Homeworks and Quizzes 20%

Class Tests (Midterms) $2 \times 20\%$

Final Comprehensive Exam 40%

Total 100%

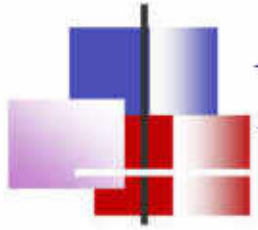
Letter grades will be given relative to the average of the class !



Tentative Schedule



- Introduction (1 two-hour lecture)
- Concepts and definitions (3 two-hour lecture)
- Evaluation of work and heat transfer (2 two-hour lecture)
- First law of thermodynamics for a control mass (3 two-hour lecture)
- Properties of a pure substance (3 two-hour lecture)
- Ideal and real gases (1 two-hour lecture)
- Term test 1 (1 two-hour lecture)
- First law of thermodynamics for a control volume (2 two-hour lecture)
- First law of thermodynamics for various equipment (1 two-hour lecture)
- Carnot cycle (1 two-hour lecture)
- Second law of thermodynamics (2 two-hour lecture)
- Term test 2 (1 two-hour lecture)
- Clausius inequality and entropy (2 two-hour lecture)
- Evaluation of entropy change and principle of increase of entropy (2 two-hour lecture)
- Second law of thermodynamics for a control volume (2 two-hour lecture)
- Efficiencies of turbines, compressors, nozzles, and diffusers (2 two-hour lecture)
- Final Exam (1 two-hour lecture)



Next Lecture



→ Chapter 1: Introduction and Basic Concepts

- Identify the unique vocabulary associated with thermodynamics through the precise definition of basic concepts.
 - Review the metric SI and the English unit systems.
- Explain the basic concepts of thermodynamics such as system, state, state postulate, equilibrium, process, and cycle.
 - Review concepts of temperature, temperature scales
- Review concepts of pressure, absolute pressure and gage pressure.