MEMS 1051
Applied Thermodynamics
Spring 2024

Course Coordinator: Professor Sam Ghalambor, Ph.D.
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Office Hours: Thursdays 11:00(AM)-1:00(PM), or by appointment

Credits and contact hours (lecture/lab): 3 Credits, 3 Contact Hours (lecture)

Designated as 'Required' or 'Elective' Course: Required

Course description: Thermodynamic processes involving energy and entropy changes in real and ideal gases, vapors, and liquids, and mixtures of those fluids. Basic thermodynamic cycles (vapor and gas power, refrigeration, and heat pumps). Air-water mixtures and psychrometrics. Thermodynamics of reactions and combustion. Applications to refrigeration, power plants, and internal combustion engines.

Prerequisite and Co-requisite: MEMS 0051

Textbook: **1)** "Fundamentals of Thermodynamics," Claus Borgnakke and Richard E. Sonntag, 8th Ed., John Wiley and Sons.
2) "Thermodynamics, an engineering approach", Yunus A. Cengel and Michael A. Boles 5th Ed., McGraw-Hill Education

Reference: **"**Fundamentals of Engineering Thermodynamics 5th ed.", Michael J. Morran, Howard N. Shapiro

Other optional materials: Engineering Equation Solver (EES) software, v.10

Course Objectives:

1. To develop additional thermodynamic tools for analyzing processes and systems.
2. To understand entropy change and entropy generation of processes and systems.
3. To learn how to apply principles of thermodynamics to analyze practical energy systems.
4. To learn basic thermodynamic cycles and their application to real systems
5. To become familiar with the practice of psychrometrics.
6. To learn how to analyze the thermodynamics of reactions and combustion processes.
7. To learn to evaluate energy systems for efficient energy utilization, and to understand the impact of energy utilization on materials and the environment.

Course learning outcomes/expected performance criteria:

1. Cycle Analysis (70%)
2. Conservation of Energy for Open Systems (70%)
3. Conservation of Energy for Closed Systems (70%)
4. Calculation and Use of Entropy (70%)
5. First and Second Law Efficiencies (70%)
6. Power Cycle Analysis (70%)
7. Heat Pump/Refrigeration Cycle Analysis (70%)
8. Calculation of Properties for Pure Substances and Simple Mixtures (70%)
9. Combustion and Reactions (70%)

Course topics and lecture hours devoted to each topic:

1. First law and thermodynamic properties
2. Conservation of energy for a control volume
3. The second law and entropy
4. Phase-change power cycles
5. Gas power cycles
6. Refrigeration and heat pump cycles
7. Project working classes
8. Nonreacting ideal gas mixtures and psychrometrics
9. Thermodynamics of combustion and reactions
10. Exams and Review

Grading Policy

The course grade will be determined based on the following contributions:

Midterm I	25%	April 11,2024
Midterm II	25%	May 30, 2024
Final Exam	40%	June 20, 2024
Homework	10%	

Disability Services

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact me or admin Staff for accommodation.

Academic Integrity

All students are expected to adhere to the standards of academic honesty. Any student engaged in cheating, plagiarism, or other acts of academic dishonesty would be subject to disciplinary action. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to the confiscation of the examination of any individual suspected of violating the University Policy.

Prepared by: Sam R. Ghalambor Date: January 10, 2024