# Thermodynamics I (ME 398), Fall 2013

Department of Mechanical Engineering, Wichita State University

| | |
|---|---|
| Instructor: | Dr. Gisuk Hwang |
| Office location/hours: | EB 101C, T/R 10:30am – 12pm or by appointment |
| Email: | Gisuk.Hwang@wichita.edu |
| Phone: | 316-978-6022 |
| Webpage: | TBA |
| Class schedule | 4:10 – 5:25 pm, Room 127 Jabara Hall |
| Prerequisites: | MATH 243 (Calc II), PHYS 313 (Phys I), or by instructor permission |
| Grader: | Anusha Chakraborthy (axchakraborthy@wichita.edu) |

**Textbook**: *Fundamentals of Engineering Thermodynamics*, 7th Ed., Wiley, by Moran, Shapiro, Boettner, and Bailey

**References**: *Fundamentals of Thermodynamics*, Wiley, 8th Ed., 2012, and *Thermodynamics* 6th Ed., Wark, McGraw-Hill, 2001

**Course Description**: the laws of thermodynamics including properties of substances and phase equilibrium, the first and second laws of thermodynamics, entropy, power cycles, refrigeration cycles, and chemical and phase equilibrium.

**Objectives**:

To gain an understanding of heat, work, and the First and Second Laws of Thermodynamics

To apply the above concepts to simple processes, including phase changes, control mass and control volume processes

**Grading**:

| | |
|---|---|
| Homework | 10% |
| Midterm exam I | 25% |
| Midterm exam II | 25% |
| Final exam | 40% |

**Reading assignments & homework:**

Students are strongly encouraged to go through the reading assignments before the class. Homework problems are assigned in Blackboard. Homework due is given at the following week, same date unless it is specified. Students are strongly encouraged to come to office hours for homework related issues, and to form study groups with your peers.

**No extra credit work will be assigned/accepted.**

**Make-up exams will be administered only upon the submission of the relevant documents, explaining the reasons for the missing ones.**

**Homework Format:**

a) Simple restatement of problem, noting information given: include sketches
b) State assumptions and indicate non-obvious logic
c) Write governing equations when used, note reasons why terms are neglected
d) Carry units in all calculations (this helps eliminate logic and math errors)
e) Clearly indicate final answer (box or underline)
f) Discuss answer (Note any particular behavior or significant points demonstrated by the problem)

**Class Schedule**

| Week | Date | Subject | Reading |
|---|---|---|---|
| 1 | 8/20 | Introductions: motivation and application | 1.1-1.2 |
| | 8/22 | Properties and states | 1.3 |
| 2 | 8/27 | Units and conservation of mass | 1.4 |
| | 8/29 | Measuring properties: temperature, pressure, density | 1.5-1.9 |
| 3 | 9/3 | Energy and work | 2.1-2.3 |
| | 9/5 | Energy transfer by heat and first law of thermodynamics | 2.4-2.5 |
| 4 | 9/10 | Energy analysis of cycles and energy storage | 2.6-2.7 |
| | 9/12 | State properties: pressure, specific volume, and temperature | 3.1-3.3 |
| 5 | 9/17 | Evaluating properties | 3.4-3.5 |
| | 9/19 | Thermodynamics properties: enthalpy, internal energy, and specific heats | 3.6-3.9 |
| 6 | 9/24 | Review:1.1-3.9 | 1.1-3.9 |
| | 9/26 | In-class midterm exam I | 1.1-3.9 |
| 7 | 10/1 | Liquid and solid, generalized compressibility and ideal gas model | 3.10-3.11 |
| | 10/3 | Ideal gas model and polytropic process relation | 3.12-3.15 |
| 8 | 10/8 | Conservation of mass for a control volume | 4.1 |
| | 10/10 | Mass rate balance and conservation of energy | 4.2-4.5 |
| 9 | 10/15 | Nozzles, diffusers, and turbines | 4.6-4.7 |
| | 10/17 | Fall break (no class) | - |
| 10 | 10/22 | Compressors and pumps and heat exchangers | 4.8-4.9 |
| | 10/24 | Throttling devices and system integration | 4.10-4.11 |
| 11 | 10/29 | Transient analysis | 4.12 |
| | 10/31 | Reviews: 3.12-4.12 | 3.12-4.12 |
| 12 | 11/5 | In-class midterm exam II: Chap. 3.12-4.12 | - |
| | 11/7 | Entropy in Closed Systems | 5.1-5.6 |
| 13 | 11/12 | Applying the second law to thermodynamic cycles | 5.5-5.7 |
| | 11/17 | Maximum performance measures | 5.8-5.9 |
| 14 | 11/19 | Carnot cycle, Clausius inequality, and Entropy | 5.10-6.4 |
| | 11/21 | Entropy change of an ideal gas and closed system | 6.5-6.8 |
| 15 | 11/26 | Entropy rate balance for control volume and isentropic process | 6.9-6.11 |
| | 11/28 | Thanksgiving day (no class) | - |
| 16 | 12/3 | Isentropic efficiencies and heat transfer | 6.12-6.13 |
| | 12/5 | Final review | 1.1-6.13 |
| | 12/10 | Final Exam (12/10, 5:40 - 7:30 pm) | 1.1-6.13 |