

ME 20000
THERMODYNAMICS I

Course Outcomes [Related ME Program Outcomes in brackets]

1. Provide a thorough understanding of the *basic concepts* of thermodynamics, (i.e., 1st and 2nd law). [A1, A2]
2. Apply the basic concepts of thermodynamics to the solution of *practical problems*. [A1, A2]
3. Develop a systematic approach to *problem-solving* skills. [A2, B1]

Definitions & Properties (3 wks)

1. State, Process, Equilibrium, Units, T, P, V
2. Problem Solving Techniques
3. p-v-T plots for pure substances
4. Internal energy and enthalpy
5. Incompressible liquid/ideal gas polytropic processes for ideal gases

**1st Law Closed System
(Control Mass) Analysis
(2 wks)**

1. Mechanical forms of work
2. Quasi-static work
3. Boundary work
4. Modes of heat transfer
5. Energy balance for closed systems
6. Energy balance for cycles

**1st Law Open System
(Control Volume) Analysis
(2 wks)**

1. Conservation of mass
2. Conservation of energy
3. Applications: nozzles, diffusers, turbines, compressors, pumps, heat exchangers, and throttles

**2nd Law Concepts
(2 wks)**

1. 2nd law statement
2. Irreversible and reversible processes
3. 2nd law limitations
4. Carnot cycle

**Entropy Balance
(3 wks)**

1. Entropy definitions/evaluations /changes
2. Entropy balance for closed and open systems
3. Isentropic processes and efficiency, reversible and steady-state, steady-flow processes

Cycle Analysis (3 wks)

1. Vapor power cycles
2. Vapor compression cycles
3. Gas power cycles (Otto, Diesel, Brayton)

1. COURSE NUMBER AND NAME: ME 20000 Thermodynamics I

2. CREDITS AND CONTACT HOURS:

- a. Lecture - 3 days per week at 50 minutes for 16 weeks

3. COURSE COORDINATOR OR INSTRUCTOR:

E.A. Groll

4. TEXTBOOK:

M. J. Moran, H.N. Shapiro, D. D. Boettner, and M. B. Bailey, *Fundamentals of Engineering Thermodynamics*, 7th ed, John Wiley and Sons, Inc., 2011.

Other Supplemental Material: None

5. SPECIFIC COURSE INFORMATION:

a. Catalog Description: First and second laws, entropy, reversible and irreversible processes, properties of pure substance. Application to engineering problems. Typically offered in fall, spring and summer.

b. Prerequisites

CHM 11500 – General Chemistry

Concurrent Prerequisites

MA 26100 Multivariate Calculus

ENGR 13200 Ideas to Innovation II

c. Status: Required

6. SPECIFIC GOALS FOR THE COURSE

a. Course Outcomes:

[Related ME Program Outcomes in brackets]

1. Provide a thorough understanding of the *basic concepts of thermodynamics* (i.e., 1st and 2nd law). [A1, A2]
2. Apply the basic concepts of thermodynamics to the solution of *practical problems in a social context*. [A1, A2]
3. Develop a systematic approach to *problem-solving skills*. [A2, B1]

b. Related ME Program Outcomes:

[Related ABET Outcomes Listed in Brackets]

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|-------------------------------|----------------------------------|
| A1. Engineering Fundamentals; | B3. Prof/Ethical Responsibility; |
| A2. Analytical Skills; | B4. Contemporary Issues; |
| A3. Experimental Skills; | B5. Life-Long Learning; |
| A4. Modern Engr Tools; | C1. Leadership, |
| A5. Design Skills; | C2. Global Engineering Skills; |
| A6. Impact of Engr Solns; | C3. Innovation; |
| B1. Communication Skills; | C4. Entrepreneurship |
| B2. Teamwork Skills | |

7. LIST OF TOPICS: See following page.

PREPARED BY: E.A. Groll

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