

MAE 11
Thermodynamics (4 units)

Class/Laboratory Schedule: four hours of lecture, eight hours of outside preparation.
12 hours/week total

Course Coordinator(s): Keiko Nomura, Zahra Sadeghizadeh

Textbooks/Materials:

1. Moran, M.J. and H.N. Shapiro, Fundamentals of Engineering; Thermodynamics, (9th edition or later), John Wiley & Sons, Inc. 2018

Catalog Description: Fundamentals of engineering thermodynamics: energy, work, heat, properties of pure substances, first and second laws for closed systems and control volumes, gas mixtures. Application to engineering systems, power and refrigeration cycles, combustion.

Prerequisites: Phys. 2C and Chem. 6A (or equivalent). Enrollment is restricted to engineering majors.

Course Type: Required

Course Objectives:

Objective 1

1.1 Students will demonstrate understanding of basic thermodynamic principles

Objective 2

2.1 Students will demonstrate the ability to apply thermodynamics principles to engineering systems

Objective 3

3.1 Students will demonstrate the ability to formulate a thermodynamic problem and use an orderly and systematic approach in the analysis and solution. This includes:

3.2 Selection of appropriate systems for analysis and identification of relevant interactions with surroundings.

3.3 Identification of known and unknown data.

3.4 Effective use of the system sketch to indicate the two previous items.

3.5 Use of property diagrams to indicate equilibrium states and processes.

3.6 Formulation of simplifying assumptions and idealizations.

3.7 Identification of relevant physical laws and relationships.

3.8 Reduction of governing equations and appropriate relationships using simplifying assumptions and manipulation to forms giving desired results, using tables, charts, and relations to evaluate thermodynamic properties.

3.9 Numerical calculations and unit conversions.

Objective 4

4.1 Students will demonstrate familiarity and basic understanding of thermodynamic applications and engineering systems

4.2 Students will demonstrate ability to apply principles and perform thermodynamic analyses of more complex systems

4.3 Students will demonstrate understanding of various design aspects, constraints, and impact in practical systems

Course Topics:

1. Basic concepts: energy, work, heat
2. Conservation of mass and energy
3. Properties of pure substances, ideal gas, incompressible substances
4. First law analysis of closed systems, control volumes, cycles
5. Second Law concepts, irreversibility
6. Carnot cycle, thermodynamic temperature scale, entropy
7. Second law analysis of closed systems, control volumes, cycles
8. Applications to power and refrigeration cycles
9. Ideal gas mixtures
10. Chemical reaction and combustion

Last Updated: 23rd June 2025