

SYLLABUS

COURSE # AND TITLE: ME 240 THERMODYNAMICS # OF CREDITS: 3

CATALOG DESCRIPTION

This first course in thermodynamics is applicable to all engineering disciplines (and modern society in general) as it deals with energy and an energy-balance approach to problem solving. The first portion is devoted to energy, energy transfer, and physical properties. The first law of thermodynamics (which relates energy to heat and work) and the second law (specifies the direction of certain processes) are then covered in detail.

Semester Offered: Spring
Prerequisites: MATH 268

Common Student Learning Outcomes

Upon successful completion of San Juan College programs and degrees, the student will....

<i>Learn</i>	<i>Students will actively and independently acquire, apply and adapt skills and knowledge to develop expertise and a broader understanding of the world as lifelong learners.</i>
<i>Think</i>	<i>Students will think analytically and creatively to explore ideas, make connections, draw conclusions, and solve problems.</i>
<i>Communicate</i>	<i>Students will exchange ideas and information with clarity and originality in multiple contexts.</i>
<i>Integrate</i>	<i>Students will demonstrate proficiency in the use of technologies in the broadest sense related to their field of study.</i>
<i>Act</i>	<i>Students will act purposefully, reflectively, and respectfully in diverse and complex environments.</i>

GENERAL LEARNING OBJECTIVES

Upon completion of the course, the student should understand the following content areas:

1. Properties and states of substances
2. The first law of thermodynamics
3. The second law of thermodynamics and entropy
4. Exergy and analysis of processes

SPECIFIC LEARNING OUTCOMES

Upon successful completion of the course, the student will be able to ...

- 1.1. Know the definition of a pure substance
- 1.2. Describe the energy transfer process in phase changes
- 1.3. Describe the various forms of internal energy in terms of the microscopic energies
- 1.4. Sketch T-v and P-v diagrams for pure substances and identify compressed liquid, saturated liquid-vapor, and superheated vapor regions
- 1.5. Interpolate property table data
- 1.6. Use the various equations of state to calculate gas properties
- 1.7. Know which properties are required to define the state of substances in and out of the liquid-vapor region

- 2.1. Know the three forms of heat transfer and be able to apply the appropriate formulas
- 2.2. Know the various forms of work and be able to apply the appropriate formulas
- 2.3. State the first law of thermodynamics (control mass) and apply the equation to physical systems
- 2.4. Know the definition for specific heat
- 2.5. Realize that many properties of ideal gases are functions of temperature alone
- 2.6. Describe how mass transfer can include energy transfer
- 2.7. Relate the conservation of mass and energy principles to the first law of thermodynamics for control volumes
- 2.8. Apply the first law for control volumes to steady-flow and uniform-flow physical systems (nozzles, diffusers, turbines, compressors, pumps, etc.)

- 3.1. Know the qualitative aspects of the second law of thermodynamics
- 3.2. Know the expression for thermal efficiency of a heat engine
- 3.3. Apply the coefficient of performance relations to heat pumps and refrigeration systems
- 3.4. Define a reversible process and describe the various irreversibilities encountered in nature
- 3.5. Sketch and describe the components of a P-v diagram for the Carnot cycle
- 3.6. State the efficiency relation for a Carnot heat engine
- 3.7. Know the definition of entropy, as it relates to the Clausius inequality
- 3.8. Describe various processes which cause entropy change
- 3.9. Apply the increase in entropy principles (control mass and control volume) to physical systems
- 3.10. Know when and how to apply entropy change relation for pure substances, incompressible substances, and ideal gases
- 3.11. Know when and how to apply reversible work relations for isentropic, polytropic, and isothermal processes
- 3.12. Define isentropic efficiency

- 4.1. Define exergy and the dead state
- 4.2. Calculate exergy for fixed mass and flowing fluid systems
- 4.3. Define second-law efficiency
- 4.4. Use an exergy balance to analyze simple engineering systems

Syllabus developed by Carl Bickford Date: 10/27/04

Syllabus reviewed by Jim Phillips Date: 10/27/04