ENGR 236 – ENGINEERING THERMODYNAMICS | 3 CREDITS

SYLLABUS

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.

Prerequisites: PHYS 215

Semester Offered: Spring

Common Student Learning Outcomes

Upon successful completion of San Juan College programs and degrees, the student will demonstrate competency in…

BROAD AND SPECIALIZED LEARNING
Students will actively and independently acquire, apply, and adapt skills and knowledge with an awareness of global contexts.

CRITICAL THINKING
Students will think analytically and creatively to explore ideas, make connections, draw conclusions and solve problems.

CULTURAL AND CIVIC ENGAGEMENT
Students will act purposefully, reflectively, and ethically in diverse and complex environments.

EFFECTIVE COMMUNICATION
Students will exchange ideas and information with clarity in multiple contexts.

INFORMATION LITERACY
Students will be able to recognize when information is needed and have the ability to locate, evaluate, and use it effectively.

INTEGRATING TECHNOLOGIES
Students will demonstrate fluency in the application and use of technologies in multiple contexts.

Student work from this class may be randomly selected and used anonymously for assessment of course, program, and/or institutional learning outcomes. For more information, please refer to the Dean of the appropriate School.

Course Learning Outcomes

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

1. Properties and states of substances
2. The first law of thermodynamics
3. The second law of thermodynamics and entropy

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 dataUse the various equations of state to calculate gas properties
1.6. 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