ENGR 2105: Thermodynamics

A. COURSE DESCRIPTION

Credits: 3
Lecture Hours/Week: 3
Lab Hours/Week: 0
OJT Hours/Week: *.*

Prerequisites:
This course requires both of these prerequisites
  MATH 2232 - Calculus II (Number of Years Valid: 5)
  PHYS 1081 - Engineering Physics I

Corequisites: None

MnTC Goals: None

This course explores the basic laws and examples of engineering applications of macroscopic thermodynamics. Students will learn an introduction to concepts and definitions of thermodynamics, energy and the first law of thermodynamics, evaluating properties, control volume energy analysis, the second law of thermodynamics, using entropy, vapor power systems, gas power systems, and refrigeration and heat pump systems.

B. COURSE EFFECTIVE DATES: 05/02/2024 - Present

C. OUTLINE OF MAJOR CONTENT AREAS

1. Recognize basic concepts of thermodynamics
2. Apply the first law of thermodynamics
3. Recognize energy conversion and general energy analysis
4. Identify properties of pure substances
5. Analyze energy in closed systems
6. Analyze mass and energy of control volumes
7. Apply the second law of thermodynamics
8. Discuss and define entropy
9. Evaluate the performance of gas power cycles
10. Demonstrate vapor and combined power cycles
11. Discuss refrigeration cycles

D. LEARNING OUTCOMES (General)

1. Demonstrate mastery of unit conversions, temperature scale conversions, and fundamental definitions involving systems, pressure, and temperature.
2. Apply the first law of thermodynamics in various physical processes including energy balances, and mechanisms of energy transfer to or from a system.
3. Describe the hypothetical substance \( \text{\text{\textit{ideal gas}}} \) and the ideal-gas equation of state.
4. Analyze closed systems undergoing processes involving phase changes in containers having moving boundaries with both insulated and diathermic walls.
5. Apply control-volume analysis for open systems involving various mechanical devices which include being able to apply the conservation of mass and the related-rate form of the first law of thermodynamics in the context of engineering steady-state flow problems.

6. Apply various forms of the second law of thermodynamics in physical situations including determining maximum efficiency of power and refrigeration cycles.

7. Describe the concept of entropy.

8. Describe power cycles.

9. Demonstrate vapor and combined power cycles.

10. Discuss refrigeration cycles.

E. Minnesota Transfer Curriculum Goal Area(s) and Competencies

   None

F. LEARNER OUTCOMES ASSESSMENT

   As noted on course syllabus

G. SPECIAL INFORMATION

   None noted