ME 3322 Thermodynamics (Required)

Catalog Description: ME 3322 Thermodynamics (3-0-3)
Prerequisites**:** PHYS 2211 General Physics I and MATH 2403
Introduction to thermodynamics. Thermodynamic properties, energy and mass conservation, entropy and the Second Law. Second Law analysis of thermodynamic systems, gas cycles, vapor cycles.

Textbook: Michael J. Moran and Howard N. Shapiro, *Fundamentals of Engineering Thermodynamics*, 6th Edition, John Wiley & Sons, 2008.

Topics Covered:

1. Definitions: property, state, closed and open systems, temperature, pressure, work interactions, heat transfer. State postulate.
2. Forms of energy: kinetic, potential, internal.
3. Properties of pure substances, equilibrium diagrams, quality. Ideal gas and incompressible substances.
4. Conservation of mass; steady and transient processes.
5. Conservation of energy; closed and open systems; steady and transient processes.
6. Introduction to Second Law; Kelvin-Planck and Clausius statements. Clausius inequality, entropy, Tds equations.
7. Second Law analysis of thermodynamic systems. Irreversibility, exergy (availability).
8. Gas power: air standard cycles, Otto, diesel, Brayton, regeneration, intercooling and reheat, component efficiencies.
9. Vapor power cycles: Rankine cycle, ideal cycle, reheat, regeneration, component efficiencies.

Course Outcomes:

Outcome 1: To teach students the basic principles of classical thermodynamics.

1.1 Students will demonstrate an understanding of the concepts of conservation of mass, conservation of energy, and the second law of thermodynamics.
1.2 Students will demonstrate an understanding of the concepts of work interaction and heat transfer.
1.3 Students will demonstrate an understanding of methods for determining thermodynamic properties of simple compressible substances.

Outcome 2: To train students to identify, formulate and solve engineering problems in classical thermodynamics involving closed and open systems for both steady state and transient processes.

2.1 Students will demonstrate the ability to identify closed and open systems.
2.2 Students will demonstrate the ability to identify work interactions and heat transfer.
2.3 Students will demonstrate the ability to determine accurately the thermodynamic properties of simple compressible substances including incompressible substances and ideal gases.
2.4 Students will demonstrate that they can apply the principles of conservation of mass and conservation of energy to the solution of problems.

Outcome 3: To teach students the application of Second Law analysis methods for thermodynamic systems.

3.1 Students will demonstrate an understanding of the concepts of Second Law analysis and an ability to apply them to closed and open systems for both steady and transient processes.

3.2 Students will demonstrate an understanding of the concepts of irreversibility, exergy (availability), adiabatic efficiency, and effectiveness.
3.3 Students will demonstrate that they can apply Second Law analysis methods to the solution of problems.

Outcome 4: To train students to analyze the performance of power and refrigeration cycles.

4.1 Students will demonstrate that they can apply the principles of conservation of mass, conservation of energy, and the Second Law of Thermodynamics to thermodynamic cycles.
4.2 Students will demonstrate the ability to analyze the performance of vapor power cycles and to identify methods for improving thermodynamic performance.
4.3 Students will demonstrate the ability to analyze the performance of gas power cycles and to identify methods for improving thermodynamic performance.

Correlation between Course Outcomes and Program Educational Outcomes:

ME 3322												
	Mechanical Engineering Program Educational Outcomes											
Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l
Course Outcome 1.1	X										X	X
Course Outcome 1.2	X										X	X
Course Outcome 1.3	X										X	X
Course Outcome 2.1	X				X						X	X
Course Outcome 2.2	X				X						X	X
Course Outcome 2.3	X				X						X	X
Course Outcome 2.4	X				X						X	X
Course Outcome 3.1	X				X						X	X
Course Outcome 3.2	X				X						X	X
Course Outcome 3.3	X				X						X	X
Course Outcome 4.1	X				X						X	X
Course Outcome 4.2	X				X						X	X
Course Outcome 4.3	X				X						X	X

Prepared by: Richard Salant