

1. EM319 Thermodynamics

2. Credit Hours (3)/Contact Hours (3),

3. Course Director – Patrick Caton

4. Moran, Shapiro, Boettner and Bailey. *Fundamentals of Engineering Thermodynamics*, 9<sup>th</sup> Ed.

5. Specific course information

- a. A basic thermodynamics course in which the first and second laws of thermodynamics are studied primarily from the classical macroscopic viewpoint and applied to both closed and open systems. Working substances include perfect gases, real gases and vapors in addition to solids and liquids. Naval applications are emphasized.
- b. Prereq: SC111; Coreq: SP211.
- c. Required for Mechanical Engineering and Aeronautical/Astronautical Engineering majors.

6. Educational objectives for the course

- a. ApplUnderstand the liquid, vapor and ideal gas properties of substances and the associated phase diagrams.
- b. Understand the state postulate and apply it in working problems.
- c. Utilize thermodynamic property tables.
- d. Understand the first law of thermodynamics and apply it to closed systems to calculate specified parameters such as work, heat transfer, or internal energy.
- e. Understand the first law of thermodynamics and apply it to open systems to calculate specified parameters such as mass flow rate, work, heat transfer, or enthalpy.
- f. Understand the second law of thermodynamics and apply it to closed and open systems to calculate specified parameters such as work, heat transfer, or entropy.
- g. Understand the concept of exergy and the calculation of exergy destruction for various processes.
- h. Understand how to analyze cycles including the Otto, Diesel, Rankine, Brayton, and vapor-compression refrigeration cycles, calculating specified parameters such as work, efficiency/COP, quality, and heat transfer..

7. Specific program outcomes addressed by this course

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Reinforced	X					X	
Mastered							

8. Brief list of topics to be covered

- a. Systems, Properties, States, Processes
- b. Units and Properties
- c. Forms of Energy
- d. Energy Transfer via Work
- e. Energy Transfer via Heat
- f. First Law of Thermodynamics and Energy Balance from Production Bookkeeping
- g. Energy Balances for Closed and Open Systems
- h. State Postulate and P-v-T Surface
- i. Incompressible Fluids and Ideal Gases
- j. Tabulated Real Property Data
- k. Generalized Compressibility
- l. Polytropic Processes
- m. Open System Mass and Energy Balances
- n. Component Analysis: Nozzles, Diffusers, Turbines, Compressors, Throttles, Heat Exchangers
- o. Second Law and the Nature of Entropy
- p. Energy Balances for Open and Closed Systems
- q. TdS Equations
- r. Isentropic Processes and Efficiencies
- s. Exergy and Exergy Balances
- t. Irreversibility
- u. Exergetic Efficiency
- v. Otto, Diesel, Brayton, Rankine, Refrigeration Cycles