United States Naval Academy
Mechanical Engineering Department

Catalog Description: EM319 Engineering Thermodynamics **Credit:** 3 (3-0-3)
Designation: Required, engineering sciences

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.

Prerequisites: None

Corequisites: SM212

Textbooks: *Fundamentals of Engineering Thermodynamics, 8th ed.* (Moran, Shapiro, Boettner, Bailey)

Course Director: Professor Patrick Caton

Course Content:

No.	Topic or Subtopic	hrs.
1	First Law Closed System	9
2	Pure Substances and State Postulate	4
3	Ideal Gas Law	4
4	First Law Open System	9
5	Entropy	4
6	Second Law	4
7	Exergy	3
8	Otto Cycle	2
9	Diesel Cycle	2
10	Rankine Cycle	2
11	Refrigeration Cycle	2
12	Brayton Cycle	2

Assessment Methods:

		YES	NO
A	Quizzes	X	
B	Homework	X	
C	Exams	X	
D	Laboratory Reports		X
E	Oral Presentations		X
F	Design Reports/Notebooks		X
G	Prototypes/Demonstrations		X
H	Projects		X
I	Other		X

Course Outcomes[1]

1. Understand the liquid, vapor and ideal gas properties of substances and the associated phase diagrams. (A, B, C)
2. Understand the State Principle and be able to apply it in working problems. (A, B, C)
3. Utilize thermodynamic property tables. (A, B, C)
4. Understand the first law of thermodynamics and can apply it to **closed** systems to calculate specified parameters such as work, heat transfer, or internal energy. (A, B, C)
5. Understand the first law of thermodynamics and can apply it to **open** systems to calculate specified parameters such as mass flow rate, work, heat transfer, or enthalpy. (A, B, C)
6. Understand the second law of thermodynamics and can apply it to **closed and open** systems to calculate specified parameters such as work, heat transfer, or entropy. (A, B, C)
7. Understand the concept of exergy and the calculation of exergy destruction for various processes. (A, B, C)
8. 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. (A, B, C)

[1] Letters in parenthesis refer to the assessment methods listed in the previous section.

	Course Outcomes							
Program Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(a)	X	X	X	X	X	X	X	X
(b)								
(c)								
(d)								
(e)	X	X	X	X	X	X	X	X
(f)								
(g)								
(h)								
(i)								
(j)								
(k)				X	X	X		

Date of Latest Revision: 1 FEB 2017, Professor Patrick Caton