COURSE: Thermodynamics EN-3211-12
SEMESTER: Fall 2022
ROOM: TBD
TIME : 0900 - 1000

INSTRUCTOR: Pete Carroll, P.E.
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ACADEMICS & LEADERSHIP: This class will focus on the application of Thermodynamics, the 2nd Law of Thermodynamics and practical analysis of basic Thermodynamic cycles. In addition to the technical aspects, I have high expectations for the display of leadership, character, morals, ethics and respect. This is in regard to one another and between you and I. I expect all students to be on-time, with textbook, notes and calculator. I expect all of you to pay attention to the lecture through eye contact and engaged with insightful questions. Phones and laptops will be out of site, or will be confiscated. This will be a fast-paced, rigorous course and will require your understanding of the homework, quizzes, in class exercises and readings, in order to do well on the tests. Attitude is everything!

TEXT: Thermodynamics, An Engineering Approach, 9th Edition by Cengal, McGraw Hill. **You are required to purchase this text book in hard copy, unless you've kept it from Eng Physics III. This is the same textbook you already were required to purchase for Engineering Physics III and should have been told to keep the text for this class.**

OFFICE HOURS: 1000am – 1050am M, W, F

ATTENDANCE POLICY: You are expected to provide advance notice and rationale for any absence; 4% will be deducted from your final grade for **each** unexcused absence. For excused absences, a legitimate excuse needs to be provided by text, phone or email **before** the beginning of class. There will be no make-ups for unexcused absences during an exam or quiz. You are not allowed to leave the room during quizzes, tests, or finals. I decide what is excused or unexcused. Use the restroom before you come to exams. You are responsible for ensuring your attendance is counted if you arrive late and you must make a copy of a binnacle sheet (if sick) for me to place in the class attendance folder. Sports participation, sickness (with binnacle sheet), or death in immediate family are excused. Bad traffic, car won't start, oversleeping and excessive lateness are all, but not totally inclusive of unexcused absences.

READ-AHEAD POLICY: Completion of all read-ahead and homework problem assignments is required. You are to be prepared for class by reading the assigned topics in the textbook, lecture notes or other sources on the assigned lecture topic before coming to class. You are expected to be able to present your understanding of read-ahead material in class when requested.

HOMEWORK POLICY: Homework is a vital component for success in this class. You must keep up with the homework, or your test performance will drop. The homework problems are from each chapter of ***Thermodynamics: An Engineering Approach, by Cengel, Boles, and Kanoglu, 9th Edition.*** The homework and exam schedule and due dates are on Blackboard, as well as a hard-copy hand-out. All work must be neat, legible, and presented in logical process. Late homework will not be accepted. You turn homework in at the beginning of class the day it is due. Homework must be in pencil. I will review the exact format of homework the 1st day of class. Homework must be completed on engineering graph paper.

TECHNOLOGY POLICY: You should bring a calculator to each class, as we will be doing real-time problem solving in each class period. Cell phones, laptops and other similar electronic devices are to be silenced and stored out of sight during class. Any use of these devices during class will require you to surrender your device for retrieval after class. You may use a scientific calculator for exams. Cellphones, smartphones and laptops are prohibited from use during quizzes and exams.

FOOD & DRINK POLCY: No food is allowed during class. Responsible use of water/soda/coffee is allowed as long as you clean up after yourself and do not perturb your colleagues.

GRADING POLICY:

- Homework 10%
- Exams 1-5 75% (15% each)
- Final 15%

*All engineering courses are analytical in nature, therefore to get full credit for any problem done, work must be shown.

Letter Grade Cut-Offs:

93 ≤ X ≤ 100	A	77 ≤ X ≤ 79	C+
90 ≤ X ≤ 92	A−	73 ≤ X ≤ 76	C
87 ≤ X ≤ 90	B+	70 ≤ X ≤ 72	C−
83 ≤ X ≤ 86	B	67 ≤ X ≤ 69	D+
80 ≤ X ≤ 82	B−	63 ≤ X ≤ 66	D
		X < 63	F

There will be no D- grades given. **You must have an average ≥ 63 in order to pass this class.**

STUDENT ACCOMMODATIONS: The Academy offers, upon request, accommodations to students with documented learning disabilities. The ADA Coordinator, Asst. Dean Elaine Craghead, evaluates the documentation provided, determines appropriate services, and is available to discuss accommodations with students. The Disability Resources office is located in the Academic Resource Center, ABSIC 320. Students can drop in during normal business hours, M-F 0800-1600, or call x5120, or email ADAcompliance@maritime.edu.

STUDENT LEARNING OUTCOMES: The main objective of the course is for the student to learn the underlying theories and principles that govern the analysis and solution of various fundamental engineering problems in BG or SI units dealing with a Newtonian fluid i.e., common liquids and gases. In doing so, the student should enhance their problem solving skills and improve their analytical competency.

At the completion of this course the student should be able to:

- Demonstrate how to apply the 1st law of Thermodynamics (Conservation of Energy) and the 2nd law of Thermodynamics (Entropy) in analyzing simple systems that involve heat, work and internal energy.
- Understand the basics of the 2nd Law of Thermodynamics and understand why it's necessary to solve practical thermodynamic problems that include refrigeration, heat pumps, and a myriad of engine cycles.
- Explain the 2nd Law of Thermodynamics and the concept of entropy.
- Describe the concepts of basic heat engines, refrigerators and heat pumps.
- Describe the Carnot Principles.
- Calculate entropy changes of solids, liquids and ideal gases.
- Analyze the Otto, Diesel and Brayton cycles.
- Analyze the Rankine cycle with reheat and regeneration.
- Analyze a simple combined cycle power plant.
- Analyze and size simple refrigerators and heat pumps.
- Define and use the terminology and concepts of air conditioning.
- Analyze and design simple air conditioning systems.

Date	Topic	Homework Problems	Due	Lecture
7-Sep-22	Introduction			1
9-Sep-22	Review			2
12-Sep-22	Thermal Reservoirs	6-5c	14-Sep-22	3
14-Sep-22	Heat Engines/Refrigerators/Heat Pumps	6-10c, 6-12c, 6-16, 6-19, 6-23, 6-30c, 6-32c, 6-33c, 6-40, 6-41, 6-44, 6-48, 6-57	16-Sep-22	4
16-Sep-22	Reversible & Irreversible Processes	6-61c, 6-62c, 6-64c, 6-67c	19-Sep-22	5
19-Sep-22	Carnot Cycle & Carnot Principles/Heat Engine	6-70c, 6-75c, 6-77, 6-81E, 6-85	21-Sep-22	6
21-Sep-22	Carnot Refrigerator/Heat Pumps	6-90c, 6-99, 6-106, 6-116c, 6-117c	23-Sep-22	7
23-Sep-22	**Exam #1**	**-**	**-**	8
26-Sep-22	Entropy/Entropy Change of Pure Substances	7-7c, 7-8c, 7-9c, 7-12c, 7-15c, 7-19c, 7-26, 7-29c	28-Sep-22	9
28-Sep-22	Isentropic Processes & Property Diagrams	7-30E, 7-34, 7-36, 7-42	30-Sep-22	10
30-Sep-22	T-ds Relations	-	-	11
3-Oct-22	Entropy Change of Incompressible Substances	7-65*	5-Oct-22	12
5-Oct-22	Entropy Change of Ideal Gases	7-70c, 7-74E, 7-86, 7-87	7-Oct-22	13
7-Oct-22	Reversible Steady Work/Isentropic Efficiency	7-103E, 7-106, 7-117E, 7-120, 7-117E, 7-120	11-Oct-22	14
10-Oct-22	**Columbus Day**			-
11-Oct-22	Exam #2 Review **(MONDAY SKED)**			15
12-Oct-22	**Exam #2**			16
14-Oct-22	Refrigeration & Heat Pumps	11-1c, 11-4E	17-Oct-22	17
17-Oct-22	Ideal Refrigeration Cycles	11-11c, 11-17, 11-18	19-Oct-22	18
19-Oct-22	Actual Refrigeration Cycles/Heat Pump Systems	11-39c, 11-41, 11-46	21-Oct-22	19
21-Oct-22	**Exam #3**	**-**	**-**	20
24-Oct-22	Dry and Atmospheric Air	14-1c, 14-2c	26-Oct-22	21
26-Oct-22	Specific & Relative Humidity	14-3c, 14-4c, 14-14, 14-16	28-Oct-22	22
28-Oct-22	Dew Point, Wet Bulb Temperature	14-21c, 14-25-c, 14-29	31-Oct-22	23
31-Oct-22	Psychrometric Chart	14-35c, 14-38	2-Nov-22	24
2-Nov-22	Air Conditioning Processes	14-65, 14-66E, 14-67	4-Nov-22	25
4-Nov-22	Air Conditioning Processes contd	14-86E	7-Nov-22	26
7-Nov-22	**Exam #4**	**-**	**-**	27
9-Nov-22	Power Cycles/Air Standard	9-6c, 9-7c, 9-12	11-Nov-22	28
11-Nov-22	**Veteran's Day**			
14-Nov-22	Reciprocating Engines/Otto Cycle	9-24c, 9-34, 9-38	16-Nov-22	29
16-Nov-22	Reciprocating Engines/Diesel Cycle	9-47c, 9-48c	18-Nov-22	30
18-Nov-22	Reciprocating Engines/Diesel Cycle	9-50, 9-56	21-Nov-22	31
21-Nov-22	**Exam #5/HW #5 Due**			32
23-Nov-22	**Thanksgiving**			-
25-Nov-22	**Thanksgiving**			-
28-Nov-22	Gas Turbines/Brayton Cycle	9-81c, 9-84E	30-Nov-22	33
30-Nov-22	Ideal Rankine Cycles	10-7c, 10-8c, 10-13c, 10-15A, 10-21	2-Dec-22	34
2-Dec-22	Actual Rankine Cycles	-	-	35
5-Dec-22	Ideal Rankine Cycle w/ Reheat	10-34, 10-35	7-Dec-22	36
7-Dec-22	Ideal Rankine Cycle w/ Regeneration	-	-	37
9-Dec-22	Cogeneration	-	-	38
12-Dec-22	Combined Gas-Vapor Power Cycles	-	-	39
14-Dec-22	**Final Exam Review**	-	-	40
15-Dec-22	**Final Week Begins**	-	-	41
Date	**Topic**	**Homework Problems**	**Due**	**Lecture**