

# Engineering Thermodynamics- EGR 271

## Block 1, 2019-20

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**Office hours:** M, W, Th: 3-4 pm, M, W, Th: 11-12, whenever I am in my office or by email.

**Textbook:** *Fundamentals of Engineering Thermodynamics*, Eighth Edition, by Michael J. Moran, Howard N. Shapiro, Daisy D. Boettner, Publisher: Wiley, Print ISBN: 9781118412930, 1118412931

**Prerequisite:** PHY 161 - General Physics I

**Class location:** 111 West Science Hall

**Daily Schedule:** We start the day at 9 am by discussing the homework assignments that you already worked on and there might be a quiz from the homework or the materials from the day before just before 10 am (you are allowed to consult your notes and solutions as long as you understood the problem). From 10 to 11 am, we work on the new materials, and in the afternoon we solve examples and deepen our understanding of the subject of the day.

We'll be visiting Prairie Creek Generating Station on Friday September 6<sup>th</sup> at 9 am.

**Course Description:** This is a four semester credit, selected elective class. Thermodynamics is the study of energy and its conversion to other forms, notably work and heat. Topics include internal energy, enthalpy, entropy and temperature; the first and second laws of thermodynamics; combustion, cyclic processes, engines, efficiency and refrigeration; heat transfer. Practical applications of thermodynamics are also discussed, including power generation, refrigeration and heat pump systems.

**Course Objectives:** This course supports the Educational Priorities and Outcomes of Cornell College with emphases on knowledge, inquiry, reasoning, and communication. Upon completion of this course, students will have a good understanding of the following concepts:

- 1- Closed systems, control volume, specific volume, temperature units, and problem-solving techniques.
- 2- Mechanical concepts of energy, definition of work, energy transfer, energy balance and First Law of thermodynamics, power cycle, refrigeration and heat pump cycles.
- 3- Evaluating the properties of materials, enthalpy, phase changes, specific heats, ideal gas model, polytropic processes.
- 4- Conservation of mass and energy for a control volume, forms of mass balance rate, nozzles and diffusers, turbines, compressors and pumps.
- 5- Second law of thermodynamics, irreversible and reversible processes, Kelvin-Planck statement, maximum performance measures for cycles operating between two reservoirs, Carnot cycle, Clausius inequality.

- 6- Entropy,  $Tds$  equations, entropy change of an ideal gas, entropy change in internally reversible processes of closed systems, entropy balance for closed systems, directionality of processes, entropy rate balance for control volumes at steady state, isentropic processes, isentropic efficiencies of turbines, compressors and pumps, heat transfer and work in internally reversible steady-state flow processes.
- 7- Vapor power systems, Rankine cycle.
- 8- Gas power systems, internal combustion engines, gas turbine power plants.

This course supports the students outcomes in Criterion 3 of ABET for baccalaureate level programs including:  
 1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics, 7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

**Assignments:**

Homework:

There are homework assignments for every day. You are expected to work on them and reach an understanding of the problem and have a good idea on how they are being solved, and the best is when you solve a problem to the end. We discuss the problems the day after (you need to come to class ready and bring your questions regarding the problems, I don't solve and explain the problems from the scratch). I might ask you to come to front of the class and explain your solution.

I grade your homework based on two criteria: 1) the work that you have done before coming to the class, 2) the work you turn in after we went over your homework questions.

List of homework problems	
Chapter 1	22, 23, 26, 31, 41, 47, 56
Chapter 2	19, 25, 35, 60, 82, 86, 90, 95
Chapter 3	12, 17, 27, 43: a, c, e, 46, 54, 65, 77, 86, 105, 111: ignore the signs in the picture, 122, 135, 142
Chapter 4	4, 20, 24, 32, 48, 53, 58, 65, 79, 85, 95, 103
Chapter 5	10, 18, 24, 39, 46, 52, 64, 78, 79, 80, 84
Chapter 6	10, 16, 21, 32, 37, 54, 59, 69, 95, 112, 133, 162, 170
Chapter 8	2, 13, 21, 35
Chapter 9	12, 24, 36

**Grades:**

First exam (second Monday)	100	Homework/ Quizzes	100
Second exam (third Tuesday)	100	Bonus points	10
Final exam (Cumulative)	150	<b>Total grade out of</b>	<b>450</b>

*Bonus points:* for brief written reports, up to two, on events/talks/discussions on campus or off campus which contribute to your liberal arts education.

A	93-100	C	74-76
A-	90-92	C-	70-73

B+	87-89	D+	67-69
B	84-86	D	64-66
B-	80-83	D-	60-63
C+	77-79	F	<60

**Students with disabilities:** Cornell College makes reasonable accommodations for persons with disabilities. Students should notify the Coordinator of Academic Support and Advising and their course instructor of any disability related accommodations within the first three days of the term for which the accommodations are required, due to the fast pace of the block format. For more information on the documentation required to establish the need for accommodations and the process of requesting the accommodations, see <http://www.cornellcollege.edu/academic-support-and-advising/disabilities/index.shtml>.

**Academic Honesty:** Cornell College expects all members of the Cornell community to act with academic integrity. An important aspect of academic integrity is respecting the work of others. A student is expected to explicitly acknowledge ideas, claims, observations, or data of others, unless generally known. When a piece of work is submitted for credit, a student is asserting that the submission is her or his work unless there is a citation of a specific source. If there is no appropriate acknowledgement of sources, whether intended or not, this may constitute a violation of the College's requirement for honesty in academic work and may be treated as a case of academic dishonesty. The procedures regarding how the College deals with cases of academic dishonesty appear in The Compass, our student handbook, under the heading "Academic Policies – Honesty in Academic Work."