Spring 1-1-2020

MET 303-002: Applied Thermodynamics

Angelantonio Tafuni

MET 303 – Applied Thermodynamics

Section 002, Spring 2020, Tue–Thu 11:30AM–12:50PM, Central King Building (CKB) Room 310

Instructor: Dr. Angelo Tafuni
Office: Faculty Memorial Hall (FMH) Room 206 **Phone:** 973–596–6187 **Email:** atafuni@njit.edu
Office Hours: Tue–Thu 2:00 PM–3:00 PM, or by email appointment

Prerequisites: Calculus (AAS level), Physics II
Corequisite: None

Textbook: Cengel, Y. *Thermodynamics, An Engineering Approach,* 9th Ed., McGraw-Hill 2019, ISBN 978-1-259-82267-4

Course Description: This course provides students with a clear understanding and a firm grasp of the basic principles of Thermodynamics. Relevant topics are the first and the second laws of thermodynamics, physical properties of pure substances, energy analysis of closed system, mass and energy analysis of control volumes.

Learning Objectives and Outcomes: By the end of the course students should be able to:

1. Determine pressure within a tank or pressure drop across a flow section or a flow device by using a manometer.
2. Apply Pascal's law to lift large weight by a small force.
3. Apply the first law of thermodynamics to derive energy balance for various systems.
4. Use property tables to evaluate properties of different pure substances at different phases.
5. Evaluate internal energy, enthalpy, and specific heats of ideal gases, solids and liquids and then calculate work done and amount of heat transfer during a process in a closed system.
6. Use conservation of energy and mass principles for different steady flow devices: nozzles and diffusers, turbine and compressors, heat exchangers etc. and analyze the thermodynamic aspects of the flow through them.
7. Determine coefficient of performance of heat pumps and refrigerators, thermal efficiency of Carnot heat engines and understand that energy has quantity as well as quality.

Student Outcomes: The Course Learning Outcomes support the achievement of the following MET Student Outcomes and TAC of ABET Criterion 9 requirements:

1. Student Outcome a - an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities. **Related CLO – 4**
2. Student Outcome b - an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies. **Related CLO – 1**
3. Student Outcome f - an ability to identify, analyze, and solve broadly-defined engineering technology problems. **Related CLO – 3**
4. Student outcome l - technical expertise in dynamics, fluid mechanics, and thermodynamics. **Related CLO – 5**

Grading Policy: The course final grade is determined as follows:

- In-class quizzes (best three @ 3.33%) 10%
- Tests (2 @ 25%) 50%
- Final Exam 40%

Course grading will be based on the standard straight scale:

- 90–100 A
- 80–90 B+ or B
- 70–80 C+ or C
- 60–70 D
- 60 or lower F

Grade break scores may vary slightly from the straight scale. This will not be known until the end of the semester. Attendance is recommended but not mandatory.

Exams: There will be two midterm examinations and a comprehensive final examination in this course. Unless otherwise specified by the instructor, all exams will be open book and notes. Throughout the semester there will also be in-class quizzes, whose dates will be announced in advance by the instructor. Of the total number of quizzes (usually six) only the best three will count towards the final grade. Missed attendance during a quiz day will result in an automatic 0/100 for that specific quiz. There will be no make-up quizzes. No exceptions will be made, including medical. The 3-out-of-6 policy not only ensures the selection of the three best grades, but also helps students that miss one or more classes during which a quiz is administered to maintain a good quiz average.

Make-up examinations will not be given under any circumstances. If you are ill or have an emergency, you need to notify and have prior approval of your instructor. In that case your grade for that exam will be added to the final examination. No extra time will be given for late arrivals to the tests. The use of any unauthorized information through calculators, smartphones or other devices is considered cheating and will result in disciplinary action (see Academic Honesty below). To receive maximum points for each exam problem you must present your work in a clear, legible manner with sufficient detail. Unexplained results, although may be correct, will not receive any credit if the logic is not clear. Learn and apply the good habits of avoiding sign/units errors and dimensional inconsistencies. You should bring each exam a numerical calculator (if allowed) that works, pencils, eraser, and maybe a straight ruler for drawing and tables. It is the responsibility of the student to be fluent in both SI and English (USCS) systems.

Homework: Homework problems will be assigned throughout the semester and will not be collected nor graded. Please remember that you may (in fact you are encouraged to) work on homework problems with your classmates. View homework as an opportunity to learn and practice. Consider "timing" your solutions as it will give you a practice for time management during tests. Please check CANVAS for announcements, homework postings and solutions, as it will be used as the main avenue of communication between the instructor and the students.

Academic Honesty: NJIT has a zero–tolerance policy regarding cheating of any kind and student behavior that is disruptive to a learning environment. Any incidents will be immediately reported to the Dean of Students. In the cases the Honor Code violations are detected, the punishments range from a minimum of failure in the course plus disciplinary probation up to expulsion from NJIT with notations on students' permanent record. Avoid situations where honorable behavior could be misinterpreted. For more information go to https://www.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf

Classroom Rules: Common courtesy (no tardiness, no food, mute cellphones, no socializing or chatting, reading newspapers, or using laptops) is expected during lectures. Class time should be participative. You should try to be part of the discussion.

Tips for Good Performance: It is important that you read the material to be covered in class beforehand. Since everyone already passed the prerequisite courses, an unsatisfactory performance usually is the result of lack of good study habits or seriousness rather than the aptitude. You should expect test problems to reflect your understanding and mastery of materials presented in class and in homework. Keep in mind that after the grades are assigned, there is no mechanism for a re-evaluation and/or extra credit. You are encouraged to come to my office during office hours or by appointment to discuss homework problems or any aspect of the course. For concise questions please use email.

Tentative Schedule* (updated on January 18, 2020):

—— = no class scheduled

Week	Dates	Topic	Reading
1	01/21, 01/23	Basic Concepts	1.1–1.7
2	01/28, 01/30	Basic Concepts, Intro to Energy	1.7–1.10, 2.1–2.2
3	02/04, 02/06	Heat and Work	2.3–2.5
4	02/11, 02/13	I Law of Thermodynamics, Efficiency	2.6–2.7
5	02/18, 02/20	Pure Substances	3.1–3.5
6	02/25, 02/27	Pure Substances (cont.)	3.6–3.8
7	03/03, **03/05**	Review Problems, **Test 1 (Ch. 1–3)**	Chapters 1–3
8	03/10, 03/12	Energy Analysis of Closed Systems	4.1–4.4
9	**03/17**, **03/19**	Spring Break Recess	–
10	03/24, 03/26	Energy Analysis of Closed Systems	4.4–4.5
11	03/31, 04/02	Mass and Energy Analysis of Control Volumes	5.1–5.3
12	04/07, 04/09	Mass and Energy Analysis of Control Volumes	5.4–5.5
13	04/14, **04/16**	Review Problems, **Test 2 (Ch. 4–5)**	Chapters 4–5
14	04/21, 04/23	II Law of Thermodynamics	6.1–6.4
15	04/28, 04/30	II Law of Thermodynamics	6.6–6.8, 6.10–6.11
16	**05/05**	Friday Classes Meet	–
17	**TBA**	**Final Exam (Ch. 1–6)**	Chapters 1–6

***Note:** although every effort will be made to keep this schedule unchanged, changes may be possible due to weather or other unforeseen events.