MET 303 - Applied Thermodynamics Syllabus

Fall 2025

Course Modality:
This is an online course, which will be conducted fully online, asynchronously via Canvas. For more information on using Canvas and other supported learning tools, visit the IST Service Desk Knowledgebase.

Instructor Information

Instructor	Email	Office Hours
Angelantonio Tafuni	atafuni@njit.edu	Available by appointment. To schedule an appointment for a one-on-one meeting with your instructor, please email your instructor.

* The instructor will respond to emails within 48 hours. Allow up to 2 weeks for feedback on submitted assignments. This feedback will be provided in Canvas.

General Information

Course Description

This course provides students with a clear understanding and a firm grasp of the basic principles of Thermodynamics that deal with energy. Topics are the first and the second laws of thermodynamics, physical properties of pure substances, energy analysis of closed systems, and mass and energy analysis of control volumes (open systems).

Prerequisites

MATH 138 or MATH 111 and PHYS 103 or PHYS 121

Course Learning Outcomes (CLO)

1. Relate thermodynamic quantities to the fundamental dimensions of mass, length, time and temperature, and evaluate their magnitudes across the different reference systems (SI, EES) using conversion factors.
2. Determine pressure within a tank or pressure drop across a flow section or a flow device by using a manometer.

3. Apply Pascal's law to determine the force required to lift large weights by a small force.
4. Apply the first law of thermodynamics to derive Energy Balance for various systems.
5. Use Property Table to evaluate properties of different pure substances at different phases.
6. 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.
7. Use conservation of energy and mass principles for different steady flow devices: Nozzles and Diffusers, Turbine and Compressors, Throttling Valves, Mixing Chambers, Heat Exchangers etc and analyze the thermodynamic aspects of the flow through them.
8. Determine coefficient of performance of Heat Pumps and Refrigerators, thermal efficiency of Carnot Heat Engine and understand that energy has quantity as well as quality.
9. Communicate effectively about topics related to thermodynamics including conservation of energy, heat and work transfer, systems efficiency, etc. through weekly discussion posts.

ABET Student Outcomes

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

- 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 to CLO–5)

- 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 to CLO–2)

- Student Outcome f - an ability to identify, analyze, and solve broadly-defined engineering technology problems

  (Related to CLO–4)

- Student outcome l - technical expertise in dynamics, fluid mechanics, and thermodynamics

  (Related to CLO–6)

Required Materials

Thermodynamics: An Engineering Approach, 10th Edition by Yunus Cengel, Michael Boles and Mehmet Kanoglu

Loose-leaf: ISBN10: 1265899975 | ISBN13: 9781265899974
E-book: ISBN10: 1265903697 | ISBN13: 9781265903695
E-book 360-day rental: ISBN10: 1265903530 | ISBN13: 9781265903534

Grading Policy

NJIT Graduate Grades

Final Grade Calculation

Final grades for all assignments will be based on the following percentages:

Slide Questions	**0%**
Quizzes	**15%**
Discussion Forums	**15%**
Assignments	**15%**
Midterm Exams (2 @15% each)	**30%**
Final Exam	**25%**

Course Work

Slide Questions: (0% of grade) While you are watching the lecture videos throughout the course, you will see slide questions pop up. You will not be able to continue the lecture video until you have answered each question. These slide questions are not graded, but they will help to prepare you for upcoming assignments and exams.

Quizzes: (15% of grade) There will be frequent multiple-choice quizzes throughout the course. They are meant to help you practice course concepts. Quizzes will be available on the learning management system (CANVAS) and will not require the use of a proctoring software. Quizzes will be due on Sundays by 5:00pm of the week they are listed.

Discussion Forums: (15% of grade) You are expected to participate in weekly discussion forums in Canvas. When all students participate in a discussion, it creates an active learning environment that will help you better understand the materials and be more successful in the class. You will post your initial response to the prompt by Fridays at 11:59pm and respond to two classmates by Sunday at 11:59pm of the week they are listed.

Assignments: (15% of grade) Assignments will be available at the end of certain modules to give you an opportunity to apply course concepts. Similar to quizzes, these activities are designed to help you practice and prepare for the exams. Only one problem per assignment will be graded, which will be randomly selected by the instructor. Assignments should be drafted and will be graded according to the Assignment Template provided. Solutions will be provided after the deadline has passed.

Exams: (**55% of grade**) There will be two midterm exams and a final exam, all administered online and carrying equal weight. All exams will utilize the learning management system (Canvas) and Respondus LockDown Browser. Exams will occur on known dates and times in the semester, available in the Course Schedule below. Unless otherwise stated, the final exam is usually scheduled on the 1st Saturday after classes end and it is cumulative. Once students start any exam assignment on Canvas, they must complete it at their first attempt and within the maximum allotted time. If not present in the lab, it is the students' responsibility to take all exams in a quiet room with a stable internet connection. Exam solutions *must* be drafted and will be graded according to the Assignment Template provided in Canvas. Submitted exam handwork that does not comply with the Assignment Template will not be graded. Makeup exams are possible *only* in the case of a serious, *documented* illness or emergency, in which case you will need to request a formal approval from the Office of the Dean of Students. No other exceptions will be made. An approval from the Dean of Students' Office is a necessary but not sufficient condition, the final decision of a makeup exam rests entirely with the course instructor.

Feedback

Allow up to 2 weeks for feedback on submitted assignments. This feedback will be provided in Canvas.

AI usage

Except for exams, the usage of artificial intelligence (AI) is permitted in this course. If and when students use artificial intelligence in this course, the AI must be cited as is shown within the NJIT Library AI citation page for AI.

Letter to Number Grade Conversions

A	90-100
B+	85-89
B	80-84
C+	75-79
C	70-74
D	60-69
F	0-59

Exam Information and Policies

NJIT policy requires that all midterm and final exams must be proctored, regardless of delivery mode, in order to increase academic integrity. Note that this does not apply to essay or authentic based assessments. Effective beginning Fall semester 2019, students registered for a fully online course section (e.g., online or Hyflex mode) must be given the option to take their exam in a completely online format, with appropriate proctoring.

Any course that uses online proctoring for exams may require you to do an environmental scan. You are responsible for selecting a location where you are comfortable with yourself and your room being video and audio recorded. You may be asked to use your camera to scan all four walls of the room you are in, as well as the workspace, desk, and area around the computer. Ideally, your exam environment should be well-lit and free from distractions and interruptions.

In this course you will be required to use the following proctoring method to ensure academic integrity for exams:

Respondus LockDown Browser

This course will be utilizing:

- LockDown Browser: A locked browser used to prevent students from printing, copying, going to another URL, or accessing other applications during an assessment in Canvas.
- Monitor: Used in conjunction with LockDown Browser, Monitor is the usage of a webcam to record a user during the exam session.

If virtual machine software is detected on your device, you won't be able to run LockDown Browser, and you'll receive a warning, "The browser can't be used in virtual machine software such as Virtual PC, VMWare, and Parallels." You can find examples of VM software and troubleshooting steps on Respondus's FAQ page for this topic.

For information about Repondus's privacy policies, please visit their Privacy Center.

In using LockDown Browser, students need:

- High-speed internet connection

Windows or Apple Operating System

In using Monitor, students need:

- Webcam (internal or external)
- Microphone and Audio (internal or external)
- NJIT ID or Photo-Issued ID
- To perform an environment check

Helpful Resources:

- Introduction to Respondus LockDown Browser for Students Video
- Respondus Monitor Resources
- Respondus Computer Requirements
- Questions or Problems? Contact:
    - Respondus Live Chat
    - IST Service Desk: 973-596-2900 or Help.njit.edu

Using LockDown Browser with "Classic" Quizzes in Canvas

To access a Classic Quiz in Canvas using LockDown Browser, students must:

1. Download and install the LockDown Browser link.
2. Locate the "LockDown Browser" shortcut on your desktop and double-click it. (For Mac users, launch "LockDown Browser" from the Applications folder.)
3. Log in with your NJIT UCID and password.
4. Click on the course within your "Courses" list in which you have to take the exam that requires LockDown Browser.
5. After you enter the course, find the exam and click on it.
6. Click the "Take the Quiz" button. Once a quiz has been started with LockDown Browser, you cannot exit until the "Submit Quiz" button is clicked.
7. If you are required to use a webcam (Respondus Monitor), you will be prompted to complete a Webcam Check and other Startup Sequence steps.

Policy for Late Work

Late work is not accepted and does not count for any credit, even partial. The only exceptions are serious, documented illnesses or emergencies, which will need to be formally approved by the Dean of Students Office (email: dos@njit.edu).
Please note that it is your responsibility to check the course calendar and deadlines frequently during the semester and to ensure that any work you do is submitted on time.

Academic Integrity

"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the NJIT academic code of integrity policy.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"

Netiquette

Throughout this course, you are expected to be courteous and respectful to classmates by being polite, active participants. You should respond to discussion forum assignments in a timely manner so that your classmates have adequate time to respond to your posts. Please respect opinions, even those that differ from your own, and avoid using profanity or offensive language.

Weekly Expectations

This course is organized by weekly modules. For each module, you must watch lecture videos, complete any reading assignments and submit any respective quizzes/exams, video quizzes and assignments. For the weekly discussion forums, initial posts are due by Friday at 11:59 pm and replies to peers are due by Sunday at 11:59 pm. Quizzes will be due on Sundays by 5:00 pm of the week they are listed.

Course Schedule

Week	Topic	Reading/Assignment	Due Dates
1	Introductory Definitions and Tools in Thermodynamics	**Read and Review:** -Book Sections 1.1-1.4 -Slides 1.1-1.5 **Watch:** -Lectures 1.1-1.5 **Submit:** -Discussion-Peer Introductions -Any quiz questions that pop up in the lecture videos. -Practice Quiz	***Discussion*** (Initial Post)-Fr 11:59pm; (Peer Reply)-Su 11:59pm ***Slide Questions*** Sa 11:59pm ***Practice Quiz*** Su 11:59 pm
2	A Closer Look at Temperature and Pressure	**Read and Review:** -Book Sections 1.5,1.6,1.8-1.10 -Slides 2.1-2.6 **Watch:** -Lectures 2.1-2.6 **Submit:** - Discussion-Using Units and Dimensions -Quiz 1 -Assignment 1 -Any quiz questions that pop up in the lecture videos.	***Discussion*** (Initial Post)-Fr 11:59pm; (Peer Reply)-Su 11:59pm ***Slide Questions*** Sa 11:59pm ***Quiz 1*** Su 5:00pm ***Assignment 1*** Su 11:59 pm
3	Introduction to Energy, Heat and Modes of Heat Transfer	**Read and Review:** -Book Sections 2.1-2.6 -Slides 3.1-3.5 **Watch:** -Lectures 3.1-3.5 **Submit:** -Discussion-Energy, Heat and Work -Any quiz questions that pop up in the lecture videos.	***Discussion*** (Initial Post)-Fr 11:59pm; (Peer Reply)-Su 11:59pm ***Slide Questions*** Sa 11:59pm
4	Work, I law of Thermodynamics, Efficiency of Mechanical Systems	**Read and Review:** -Book Sections 2.4-2.7 -Slides 4.1-4.5 -Article-First Law of Thermodynamics **Watch:** -Lectures 4.1-4.5 -Web video (above article) **Submit:**	***Discussion*** (Initial Post)-Fr 11:59pm; (Peer Reply)-Su 11:59pm ***Slide Questions*** Sa 11:59pm ***Quiz 2*** Su 5:00pm ***Assignment 2***

Week	Topic	Reading/Assignment	Due Dates
		-Discussion-Energy Conservation Principle -Quiz 2 -Assignment 2 -Any quiz questions that pop up in the lecture videos.	Su 11:59 pm
5	Pure Substances: Definition and Properties	**Read and Review:** -Book Sections 3.1-3.4 -Slides 5.1-5.5 **Watch:** -Lectures 5.1-5.5 **Submit:** -Discussion-Phase Change of Water -Any quiz questions that pop up in the lecture videos.	***Discussion*** (Initial Post)-Fr 11:59pm; (Peer Reply)-Su 11:59pm ***Slide Questions*** Sa 11:59pm
6	Property Tables and Ideal Gas Relations	**Read and Review:** -Book Sections 3.5-3.8 -Slides 6.1-6.4 **Watch:** -Lectures 6.1-6.4 **Submit:** -Discussion-Property Tables of Water -Quiz 3 -Assignment 3 -Any quiz questions that pop up in the lecture videos.	***Discussion*** (Initial Post)-Fr 11:59pm; (Peer Reply)-Su 11:59pm ***Slide Questions*** Sa 11:59pm ***Quiz 3*** Su 5:00pm ***Assignment 3*** Su 11:59 pm
7	**Review and Preparation for Midterm Exam 1**	**Review:** -Book sections covered in modules 1-6 **Submit:** -Discussion-Review for Midterm Exam 1 -Review Assignment 1 -Midterm Exam 1	***Review Assignment 1*** (2 days prior to the exam window) ***Midterm Exam 1*** (exam window to be announced first week of semester)
8	I Law of Thermodynamics for Closed Systems	**Read and Review:** -Book Sections 4.1-4.4 -Slides 8.1-8.4 **Watch:** -Lectures 8.1-8.4 **Submit:** -Discussion -Energy Transfer in Closed Systems -Any quiz questions that pop up in the lecture videos.	***Discussion*** (Initial Post)-Fr 11:59pm; (Peer Reply)-Su 11:59pm ***Slide Questions*** Sa 11:59pm
9		**Read and Review:** -Book Sections 4.4-4.5 -Slides 9.1-9.5 **Watch:**	***Discussion*** (Initial Post)-Fr 11:59pm; (Peer Reply)-Su 11:59pm ***Slide Questions***

Week	Topic	Reading/Assignment	Due Dates
	Specific Heats and Enthalpy of Gasses and Liquids	-Lectures 9.1-9.5 **Submit:** -Discussion-Adiabatic Processes for an Ideal Gas -Quiz 4 -Assignment 4 -Any quiz questions that pop up in the lecture videos.	Sa 11:59pm ***Quiz 4*** Su 5:00pm ***Assignment 4*** Su 11:59 pm
10	I Law of Thermodynamics for Open Systems	**Read and Review:** -Book Sections 5.1-5.2 -Slides 10.1-10.6 -Article-Can Turbulent Flow Be Steady? **Watch:** -Lectures 10.1-10.6 **Submit:** -Discussion-The Concept of Steadiness in Turbulent Fluid Flow -Any quiz questions that pop up in the lecture videos.	***Discussion*** (Initial Post)-Fr 11:59pm; (Peer Reply)-Su 11:59pm ***Slide Questions*** Sa 11:59pm
11	Steady-flow Open Systems Examples	**Read and Review:** -Book Sections 5.3-5.4 -Slides 11.1-11.6 **Watch:** -Lectures 11.1-11.6 **Submit:** -Discussion-Performance of an Air Compressor -Quiz 5 -Assignment 5 -Any quiz questions that pop up in the lecture videos.	***Discussion*** (Initial Post)-Fr 11:59pm; (Peer Reply)-Su 11:59pm ***Slide Questions*** Sa 11:59pm ***Quiz 5*** Su 5:00pm ***Assignment 5*** Su 11:59 pm
12	**Review and Preparation for Midterm Exam 2**	**Review:** -Book sections covered in modules 8-11 **Submit:** -Discussion-Review for Midterm Exam 2 -Review Assignment 2 -Midterm Exam 2	***Review Assignment 2*** (2 days prior to the exam window) ***Midterm Exam 2*** (exam window to be announced first week of semester)
13	II Law of Thermodynamics	**Read and Review:** -Book Sections 6.1-6.4 -Slides 13.1-13.4 **Watch:** -Lectures 13.1-13.4 **Submit:** -Discussion-Theoretical Limits of a Heat Engine	***Discussion*** (Initial Post)-Fr 11:59pm; (Peer Reply)-Su 11:59pm ***Slide Questions*** Sa 11:59pm

Week	Topic	Reading/Assignment	Due Dates
		-Any quiz questions that pop up in the lecture videos.	
14	Heat Engines & Refrigerators	**Read and Review:** Book Sections 6.6-6.8, 6.10-6.11 Slides 14.1-14.3 **Watch:** Lectures 14.1-14.3 **Submit:** -Discussion-Power Estimation for Air Conditioning in Your House. -Quiz 6 -Assignment 6 -Any quiz questions that pop up in the lecture videos.	***Discussion*** (Initial Post)-Fr 11:59pm; (Peer Reply)-Su 11:59pm ***Slide Questions*** Sa 11:59pm ***Quiz 6*** Su 5:00pm ***Assignment 6*** Su 11:59 pm
15	**Final Exam**	**Review:** -Book sections covered in modules 1-14 **Submit:** -Review Assignment 3 -Final Exam	***Final Exam*** (exam window to be announced first week of semester)

Additional Information and Resources

Accessibility:

This course is offered through an accessible learning management system. For more information, please refer to Canvas's Accessibility Statement.

Requesting Accommodations:

The Office of Accessibility Resources and Services works in partnership with administrators, faculty, and staff to provide reasonable accommodations and support services for students with disabilities who have provided their office with medical documentation to receive services.

If you are in need of accommodations due to a disability, please contact the Office of Accessibility Resources and Services to discuss your specific needs.

Resources for NJIT Online Students

NJIT is committed to student excellence. To ensure your success in this course and your program, the university offers a range of academic support centers and services. To learn more, please review these Resources for NJIT Online Students, which include information related to technical support.