Fall 2025: ME 311 S001 Thermodynamics I

Department of Mechanical and Industrial Engineering
New Jersey Institute of Technology (NJIT)
Newark, NJ 07012, USA

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Class: Days/Times – Mondays/Wednesdays (11:30 AM – 12:50 PM); Credits – 3.00

Section	CRN	Days	Times	Location	Status	Max	Now	Instructor
001	94473	MW	11:30 AM - 12:50 PM	ME 224	Closed	43	49	Datta, Dibakar

TIMELINE: Lectures, Practice Sets, Exams

DATE	LECTURE	Practice Set	EXAMINATION
September 03 (W)	Lecture 01	Practice Set **1**	
September 08 (M)	Lecture 02		
September 10 (W)	Lecture 03	Practice Set **1** Solution Practice Set **2**	
September 15 (M)	NO CLASS (US National Science Foundation Meeting)		
September 17 (W)	Lecture 04		
September 22 (M)	Lecture 05	Practice Set **2** Solution	
September 24 (W)	**Exam 1** Exam 1 Solution		
September 29 (M)	Lecture 06	Practice Set **3**	
October 01 (W)	Lecture 07		Exam 1 GRADE
October 06 (M)	Lecture 08	Practice Set **3** Solution Practice Set **4**	
October 08 (W)	Lecture 09		
October 13 (M)	Lecture 10		
October 15 (W)	Lecture 11	Practice Set **4** Solution	

October 20 (M)	**Exam 2** Exam 2 Solution		
October 22 (W)	Lecture 12	Practice Set **5**	
October 27 (M)	Lecture 13		Exam 2 GRADE
October 29 (W)	Lecture 14		
November 03(M)	Lecture 15		
November 05(W)	Lecture 16	Practice Set **5** Solution	
November 10(M)	**Exam 3** Exam 3 Solution		
November 12(W)	Lecture 17	Practice Set **6**	
November 17(M)	Lecture 18		Exam 3 GRADE
November 19(W)	Lecture 19		
November 24(M)	Lecture 20		
December 01(M)	Lecture 21	Practice Set **6** Solution	
December 03(W)	**Exam 4** Exam 4 Solution		
December 08(M)	Lecture 22		
December 10(W)	Lecture 23		Exam 4 GRADE
FINAL EXAM date and time will be announced by NJIT			

Prerequisites: Math 213- Calculus-III-B; Phys 111-Physics 1

Book: Yunus A. Cengel & Michael A. Boles; Thermodynamics - An Engineering Approach; 8th Edition; Published by McGraw-Hill Education

Method of Lectures: In-person.

Office Hours: There are no specific office hours. Please email me to schedule an appointment. We can meet in any day at our mutually convenient time.

Lecture Notes and Study Materials: We will NOT blindly follow this textbook. You will receive lecture notes/slides and additional study materials in every class. Moreover, you will be provided many videos for a clear understanding of the concept.

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 academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

NJIT's Perspective on AI Usage in Teaching/Learning:

https://www.njit.edu/emergingtech/njits-perspective-ai-usage-teachinglearning#tab-2

Course Description:
Thermodynamic fundamentals. Introduction to the basic concept of energy and the laws governing the transfer and transformation of energy. Thermodynamic properties and the application of the first and second laws of thermodynamics in the analysis of closed and open systems. Availability analysis is introduced. These concepts are then integrated into the analysis of simple cycles.

Outcome of the course:

1. Identify the properties of real substances, such as water from tabular data, ideal gases from tabular data or equation of state and other real gases P,v,T, data through the use of the compressibility charts.
2. Analyze processes involving real substances and ideal gases as working fluid in both the open and closed systems, apply the first law, the conservation of mass to perform both mass and energy balances, sketch process diagrams, and to determine work and heat transfers.
3. Analyze open and closed systems through the application of the second law of thermodynamics as well as applying the energy concept.
4. Analyze some simple thermodynamic cycles.

Grading Policy:

The final grading will be based on –

(1) Class Attendance & Quiz Performance (10%)

Attendance will be taken in every class, and there will be a quiz in each session. Attendance and quiz performance together will account for 10% of the total grade.

(2) Four Mid-Term Exams (4 x 16 = 64%)

(3) Final Exam (26%)

PRACTICE PROBLEM SETS: Many practice problem sets will be provided. Solutions to these sets will also be posted, in addition to in-class discussions.

Final Grading:

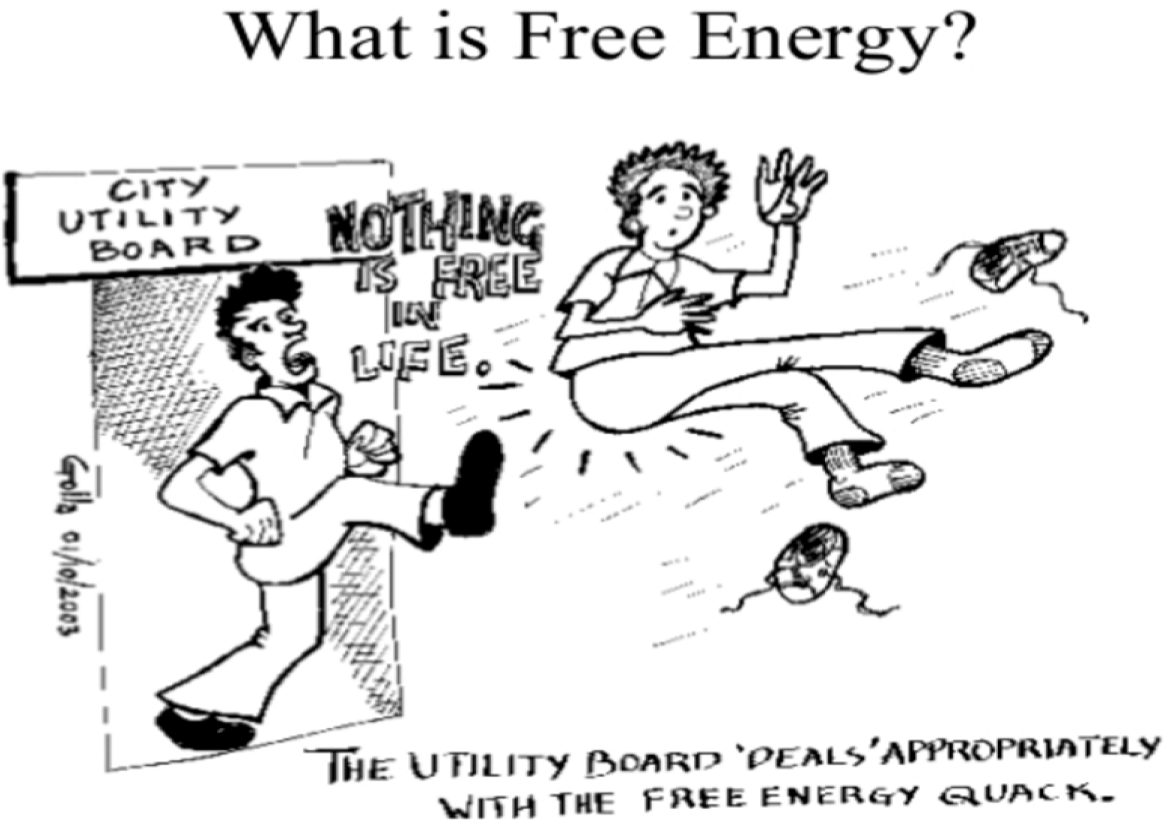
Grades	Significance	Overall Score
A	Superior	90 - 100
B+	Excellent	80 - 89
B	Very Good	70 - 79
C+	Good	60 - 69
C	Acceptable	50 - 59
D	Minimum	40 - 49
F	Fail/Inadequate	< 40

Timeline and Syllabus

Week	Topic
1 & 2	**Introduction and Basic Concepts** Thermodynamics and Energy, Importance of Dimensions and Units, Systems and Control Volumes, Properties of a System, Density and Specific Gravity, State and Equilibrium, Processes and Cycles, Temperature and the Zeroth Law of Thermodynamics, Pressure, Pressure Measurement Devices, Problem-Solving Technique

2 & 3	**Energy, Energy Transfer, and general Energy Analysis** Forms of Energy, Energy Transfer by Heat, Energy Transfer by Work, Mechanical Forms of Work, The First Law of Thermodynamics, Energy Conversion Efficiencies, Energy and Environment
4 & 5	**Properties of Pure Substances** Pure Substance, Phases of a Pure Substance, Phase-Change Processes of Pure Substances, Property Diagrams for Phase-Change Processes, Property Tables, The Ideal-Gas Equation of State, Compressibility Factor—A Measure of Deviation from Ideal-Gas Behavior, Other Equations of State
6 & 7	**Energy Analysis and Closed Systems** Moving Boundary Work, Energy Balance for Closed Systems, Specific Heats, Internal Energy, Enthalpy, and Specific Heats of Ideal Gases, Internal Energy, Enthalpy, and Specific Heats of Solids and Liquids
7 & 8	**Mass and Energy Analysis of Control Volumes** Conservation of Mass, Flow Work and the Energy of a Flowing Fluid, Energy Analysis of Steady-Flow Systems, Some Steady-Flow Engineering Devices, Energy Analysis of Unsteady-Flow Processes
9, 10 & 11	**The Second Law of Thermodynamics** Introduction to the Second Law, Thermal Energy Reservoirs, Heat Engines, Refrigerators and Heat Pumps, Perpetual-Motion Machines, Reversible and Irreversible Processes, The Carnot Cycle, The Carnot Principles, The Thermodynamic Temperature Scale, The Carnot Heat Engine, The Carnot Refrigerator and Heat Pump
12, 13 & 14	**Entropy** Entropy, The Increase of Entropy Principle, Entropy Change of Pure Substances, Isentropic Processes, Property Diagrams Involving Entropy, What Is Entropy? The Tds Relations, Entropy Change of Liquids and Solids, The Entropy Change of Ideal Gases, Reversible Steady-Flow Work, Minimizing the Compressor Work, Isentropic Efficiencies of Steady-Flow Devices, Entropy Balance

Nothing is free in life! You must work hard to shine in your life.



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