Fall 2024

ME 311-001: Thermodynamics I

Dibakar Datta

Fall 2024: ME 311 S001 Thermodynamics I

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

Instructor: Dr. Dibakar Datta
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Class: Days/Times –Mondays/Wednesday (11:30 AM – 12:50 AM); Credits – 3.00

ME 311 - THERMODYNAMICS I

Section	CRN	Days	Times	Location	Status	Max	Now	Instructor	Delivery Mode	Credits	Info
001	94327	MW	11:30 AM - 12:50 PM	CULM 111	Closed	35	35	Datta, Dibakar	Face-to-Face	3	Book

TIMELINE: Lectures, Homework, Exam

DATE	LECTURE	HOMEWORK	EXAMINATION
September 04	Lecture 01	Homework **01** given	
September 09	Lecture 02		
September 11	Lecture 03		
September 16	Lecture 04		
September 18	Lecture 05		
September 23	Lecture 06	**Homework 01 DUE** Homework 01 solution given	
September 25	Lecture 07		
September 30	Lecture 08	Homework 01 GRADE given	
October 02			**Exam 01** Exam 01 solution given
October 07	Lecture 09	Homework **02** given	
October 09	Lecture 10		Exam 01 GRADE given
October 14	Lecture 11		
October 16	Lecture 12		
October 21	Lecture 13		

October 23	Lecture 14	**Homework 02 DUE** Homework 02 solution given	
October 28	Lecture 15		
October 30	Lecture 16	Homework 02 GRADE given	
November 04			**Exam 02** Exam 02 solution given
November 06	Lecture 17	Homework **03** given	
November 11	Lecture 18		Exam 02 GRADE given
November 13	Lecture 19		
November 18	Lecture 20		
November 20	Lecture 21		
November 25	Lecture 22	**Homework 03 DUE** Homework 03 solution given	
December 02	Lecture 23	Homework 03 GRADE given	
December 04			**Exam 03** Exam 03 solution given
December 09	Lecture 24		
December 11	Lecture 25		Exam 03 GRADE given
FINAL EXAM DATE AND TIME WILL BE ANNOUNCED SOON			

Prerequisites: Math 211- Calculus 111; 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:

There will be NO generosity in grading. Your final grading will be EXACTLY based on your performance in the exams.

The final grading will be based on three homework, three exams, one final exam.

(1) Three Homework (3 x 10 = 30%)

(2) Three Mid-Term Exams (3 x 15 = 45%)

(3) Final Exam (25%)

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

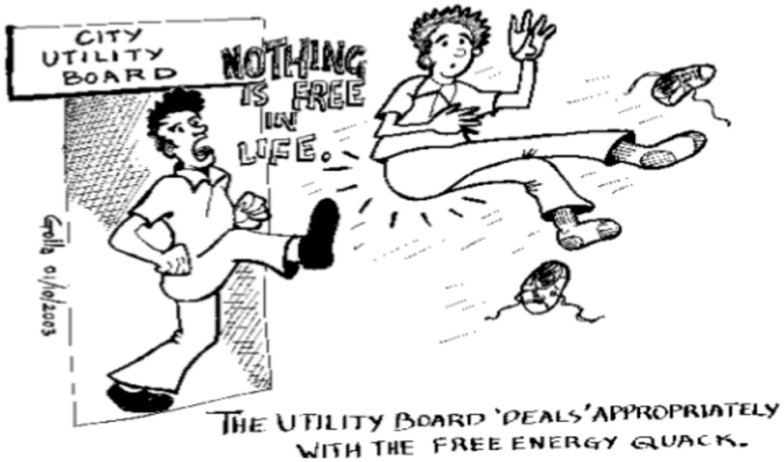
Timeline and Syllabus

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.

What is Free Energy?



(Picture from Web)