ME 311 Thermodynamics 13S- Text- Cengel & Boles Thermodynamics- An Engineering Approach- 7th Ed & Property Table Booklet for 7th Ed.
Prerequisites- Math 211 and Physics 111

" The Book and Lecture will 'teach' you little unless are willing to put an active, organized effort into the learning process. Active- directed work is necessary to understand and remember the material."

Course Syllabus -Florio

Week	Topic	Sections	Problems
1	Introduction, Definitions, Units, Systems	1.1-1.3	1-8, 20C,
	Properties, State, Processes, Cycles	1.4-1.7	25C, 83,125
	State postulate, Temperature	1.8-1.9	79
	Pressure, Problem-Solving, Energy	1.10-1.13, 2.1	
2	Heat Transfer, Work	2.2-25	2.26, 32E,
	The First Law of Thermodynamics	2.6	53, 61, 69
	Energy Conversion Efficiencies	2.7	38, 41, 127
3	Pure Substance, Phase-Change	3.1-3.3	3-28, 30
	Property Diagrams	3.4	38, 46, 61
	Thermodynamic Property Tables	3.5	
4	The Ideal-Gas Equation of State	3.6	3-78, 87, 95
	Compressibility Factor, Other Equations of State	3.7-3.8	
	Moving Boundary Work	4.1	
Test 1 for Chapters 1 to 3.6			
5	Energy Balance for Closed Systems	4.2	4-28, 35, 55
	Specific Heats	4.3	73, 74, 91
	Internal Energy, Enthalpy, Specific Heats for Ideal Gases	4.4	
	Internal Energy, Enthalpy, Specific Heats of Solids and Liquids	4.5	
6	Mass Balance for Control Volumes	5.1	
	Flow Work and the Energy of a Flowing Fluid	5.2	5.12, 39
	Energy Balance for Steady-Flow Systems	5.3	
7	Some Steady-Flow Engineering Devices	5.4	5-41,
	Nozzles, Diffusers	5.4	48, 66,
	Turbines, Compressors	5.4	77, 96, 178
	Throttling valves, Mixing chambers	5.4	
Test 2 for Chapters 4-5.5			
8	Heat exchangers, Pipe and Duct Flow	5.4	178,148
	Unsteady-flow process	5.5	155
	Introduction to the Second law, Thermal Reservoirs	6.1-6.2	
	Heat engines	6.3	

Week	Topic	Sections	Problems
9	Refrigerators, Heat Pumps, Perpetual-Motion Machines	6.4-6.5	
	Reversible & Irreversible Processes, Carnot cycle	6.6-6.7	6-18
	Carnot Principles, The Thermodynamic Temperature Scale	6.8-6.9	6.43,57
10	Carnot Heat Engine	6.10	6.63,71
	Carnot Refrigerator and Heat Pump	6.11	76, 103
	Entropy	7.1	
	The Increase of Entropy Principle	7.2	
11	Entropy Change of Pure Substance, Isentropic Processes	7.3-7.4	7-7C, 39, 48
	Property Diagrams Involving Entropy, What Is Entropy	7.5-6.6	52, 82
	T ds Relations, Entropy Change of Liquids and Solids	7.7-7.8	67, 125, 146
12	Entropy change of Ideal Gases	7.9	156, 133
	Reversible Steady-Flow Work, Compressor work	7.10-7.11	
	Isentropic Efficiencies of Steady-Flow Devices	7.12	
	Entropy Balance	7.13	
Test 3 for Chapters 6-to 7.13			
13	Exergy, Reversible Work, Irreversibility, Second-Law Efficiency	8.1-8.3	
	Exergy Change of a System	8.4	8.40, 80
	Exergy Transfer by Heat, Work, and Mass	8.5	61, 139
14	Exergy Destruction	8.6	
	Exergy Balance: Closed System	8.7	
	Exergy Balance: Control Volumes	8.8	

Course Grading Information. –. Sections 002, 004 ME 311-2013- Tests-closed textbook & notes, use of property table booklet permitted . **No storage of any equations on calculators. A calculator is to be *used* solely for computational operations only**. **No cell phones, nor any communication devices are permitted**. No sharing of any material or calculator is permitted. All solutions must be **complete** and logical. Equation development must exist before numerical substitution.
a. Tests – 20% **; Grade for any missed test will be recorded as a grade of zero ..**
b. *All work submitted must be in pencil. Any required homework problem must be in the format specified–Any problems due must be submitted at the start of class. No Make-up.
It is expected that the reading assignment will be complete prior to the discussion of the material in class.. Graded material will only be brought to class once. All tests must be returned for proper ABET recording.
c. Class participation –you are expected to sign the attendance sheet at each class and actively participate-.Participation +Short quizzes+any required homework + attendance =Semester total =10%,
d. Comprehensive Final Exam - 30%
e. The NJIT Integrity Conduct Code will be strictly enforced. Any violations will be reported to the Dean of Students.
f. Work copied or the use of unauthorized aid will not be accepted or graded .

Cell phones must be turned off during class. Use of any communication or equivalent device during class or during a test (quiz) is prohibited. Use of Laptops or any communication or equivalent device during a test or class is prohibited
Text and Property booklet are required for each student
Reserve right to modify as necessary.
Assignment Sheet usually available at:
web.njit.edu/~florio/FLORIO.htm

Course Motivation: This course is an introduction to the concept of energy. It provides the basic tools necessary for the analysis of any engineering system in which energy transfer or energy transformations occur; thus, thermodynamics is an important part of the training of almost all engineering disciplines.

Homework: Homework is an important part of this course. You are expected to have solved every assigned problem. Questions on the homework problems should be brought up in class.
Format for **submitted work** : Solutions in pencil. Each problem starts on a separate page, 8.5 x11, with all pages stapled together. Format

1. Known: A brief summary of the problem, "in your own words".
2. Find: Quantities to be determined.
3. Sketch: The physical system and property diagrams
4. Assumptions: Assumptions to be used in solving the problem are listed.
5. Properties: Material properties needed, values and sources.
6. Analysis: The problem is solved in a systematic and logical manner, showing all steps, the fundamental equation from which the analysis begins and numerical values (with units) shown. Answers clearly indicated.
7. Discussion: Any comments relative to the results.

Quizzes- There could be periodic short quizzes covering assigned problems and lecture material . Any missed quiz is recorded as a grade of zero.

Tests. Generally 4 problems which are similar to the class problems, HW, Short quizzes. Tests stress the following levels**: knowledge, comprehension, application, and analysis**.

Final Grade. Assigned based " on a curve"

Attendance: You are expected to attend all classes and to sign the daily attendance sheet.

Specific Course Objectives: The students will be asked to demonstrate their knowledge of the material covered in this first thermodynamics course through their mastery of the following course objectives. Through the study of this material the student will be able to:

1. **Determine properties of real substances, such as steam and refrigerant 134-a, and ideal gases from either tabular data or equations of state**.
   - Use absolute, gage, and vacuum pressures correctly.
   - Calculate pressures using the manometer equation.
   - Use absolute and Celsius temperatures correctly.
   - Determine property data using the steam and R-134a tables & ideal gas tables .
   - Sketch P-v, T-v, and P-T plots for steam, R-134a, and ideal gases.
   - Locate data states on P-v, T-v, P-T and T-S plots for steam, R-134a, and ideal gases.
   - Determine the condition of a data state as a compressed, saturated, or superheated state and determine the thermodynamic properties at that state by using property tables.
   - Demonstrate the use of quality in finding properties of two-phase substances.
   - Apply the concept of the generalized compressibility factor to demonstrate when the ideal gas equation may be used to determine the state of a gas.
   - Apply the ideal gas equation to solve problems involving pressure, temperature, and volume of ideal gases.
   - Determine changes in internal energy and enthalpy for ideal gases.
   - Determine mass flow rate from its definition and relation to volume flow rate.

2. **Analyze processes involving ideal gases and real substances as working fluids in both closed systems and open systems or control volumes to determine process diagrams, apply the first law of thermodynamics to perform energy balances, and determine heat and work transfers.**
   - Determine the pressure-volume relation for processes and sketch the processes on P-v and T-v diagrams.
   - Calculate the boundary work for a variety of processes for closed systems.
   - Apply the first law to closed systems containing ideal gases, steam, or R-134a to determine heat transfer, work, or property changes during processes.
   - Apply the first law to steady-flow open systems containing ideal gases, steam, and refrigerant-134a to determine heat transfer, work, and property changes during processes.

3. **Analyze systems and control volumes through the application of the second law.**
   - Determine the efficiency of heat engines and compare with the Carnot heat engine efficiency.
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   - Determine the coefficient of performance of refrigerators and heat pumps and refrigerators and heat pumps operating on the reversed Carnot cycle.
   - Determine entropy changes for both ideal gases and real substances.
   - Sketch processes on both P-v and T-s diagrams.
   - Determine the properties of a working fluid at the end of an isentropic process.
   - Apply both the first and second laws to determine heat transfer, work, and property changes during processes occurring in both closed and open systems.

4. **Analyze systems through the application of the concepts of exergy (availability).**.