17F ME 311 Thermodynamics 17F Required Text- Cengel & Boles Thermodynamics- An Engineering Approach- 8th Ed & Property Table Booklet for 8th Ed(Book as well as booklet are Required).

Pre-requisites- 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."

Technicians are told "how", engineers are expected to know "why" as well as how.

Course Syllabus -Florio

Week	Topic	Sections	Problems
1	Introduction, Definitions, Units, Systems	1.1-1.3	1-12, 27C,
	Properties, State, Processes, Cycles	1.4-1.7	33C, 75,125
	State postulate, Temperature	1.8-1.9	62
	Pressure, Problem-Solving, Energy	1.10-1.13, 2.1	
2	Heat Transfer, Work	2.2-25	2.26, 35,
	The First Law of Thermodynamics	2.6	43, 50, 68
	Energy Conversion Efficiencies	2.7	39, 74
3	Pure Substance, Phase-Change	3.1-3.3	3-23, 28, 30
	Property Diagrams	3.4	39, 45, 61
	Thermodynamic Property Tables	3.5	
4	The Ideal-Gas Equation of State	3.6	3-78, 87, 91
	Compressibility Factor, Other Equations of State	3.7-3.8	
	Moving Boundary Work	4.1	

Test 1 chapters 1-3

5	Energy Balance for Closed Systems	4.2	4-28, 37, 55
	Specific Heats	4.3	76, 84
	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, 65,
	Turbines, Compressors	5.4	77E, 96
	Throttling valves, Mixing chambers	5.4	

Test 2

8	Heat exchangers, Pipe and Duct Flow	5.4	76, 81

	Unsteady-flow process	5.5	
	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, 57C
10	Carnot Heat Engine	6.10	6.63,75
	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, 38, 49
	Property Diagrams Involving Entropy, What Is Entropy,	7.5-6.6	52, 81
	T ds Relations, Entropy Change of Liquids and Solids	7.7-7.8	67, 137, 141
12	Entropy change of Ideal Gases	7.9	153, 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			
13	**Exergy**, Reversible Work, Irreversibility, Second-Law Efficiency	8.1-8.3	
	Exergy Change of a System	8.4	8.38, 80
	Exergy Transfer by Heat, Work, and Mass	8.5	62, 98
14	Exergy Destruction	8.6	
	Exergy Balance: Closed System	8.7	
	Exergy Balance: Control Volumes	8.8	

Course Grading Information.

ME 311 17- All Tests and short quizzes are closed book and notes. As necessary, a formula sheet may be provided. A **standard calculator, with no storage of equations or information permitted, and published property tables (copied Tables are not allowed) are required. (No Copies permitted) Cell phones, laptops, tablets and smart watches or any other communication devices are not permitted.**

No sharing of any material or calculator is permitted. All solutions must be complete and logical. (See Homework section) All solutions must begin with the problem defined, and a system definition. This must be followed by the development of the modeling equation and if necessary numerical substitution.

Graded tests will be brought to class only once, and must be returned to the instructor to be recorded.

It is the student's responsibility to notify the instructor of any possible errors in grading of the test on the day the test is returned and by the end of class.

Any possible test conflicts must be reported at least one week prior to the date of the test/exam and will not be accepted after the test is given. Any reported conflicts must be consistent with the NJIT policy or procedure and/ or approved by the Dean of students.

Integrity: "A student signature is required on any exam or assignment and is understood as compliance with the academic integrity policy. No unauthorized aid was given or received. Work copied or obtained through the use of any unauthorized aid (authorized only by the instructor) at a minimum will not be accepted. For general homework problems- only- form of authorized aid includes discussing the problem statement, approaches for problem solving, and basic concepts related to the problem with other students in your class. Unauthorized aid includes but is not limited to use of solutions manuals or other solution materials or another individual's work, in part or in whole." LAF

Cell phones, tablets and laptops, etc. must be turned off during class. Use of any communication device during a exam, test(quiz) is prohibited.

Assignment Sheet usually available at: *moodle and* ***web.njit.edu/~florio/FLORIO.htm***

The instructor reserves the right to modify this syllabus as needed

ME 311 Syllabus - continued

Course Grading Information. .
a. **Tests – 18Pts each ; Grade for any missed test will be recorded as a grade of zero . Tests stress the following levels: knowledge, comprehension, application, and analysis . The tests are graded accordingly. Format for tests is the same as that for homework.**
b.***All work submitted must be in pencil**. Any required homework problem must be in the format specified–Any due problems must be submitted at the start of class. No Make-up.
c. **Class participation** –you are expected to sign the attendance sheet at each class and actively participate. Class participation - If your average grade on tests is at least 60 pts , and an active class participation score, at **most 5pts,** could be added to your score.
d. **Comprehensive Final Exam - 36Pts -** No make-up will be given without the **prior** approval of the Dean of Students.
e. Short quiz- and any required homework maximum **5Pts No make –up.**
f. Work copied or the use of unauthorized aid as a minimum will not be accepted or graded. See Integrity
g. Final grades will be based on a curve and be consistent with course objectives.

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 (HW) is an important part of the course. You are expected to solve every assigned problem.
See homework format

There might be a number of **–"special"** take home assignments.
For those take home assignments – they must be done solely by you without consulting any other individual or individuals.
The instructor reserves the right to change homework assignments.

Homework Format

"Homework is an important part of this course. It is a necessary part of understanding and learning of the course material. You are expected to have solved every assigned problem. It is the student's responsibility to learn how to arrive at the final solution." LAF

It is not necessary to memorize numerous equations, for problems are best solved by use of the definitions and the applications of the laws of thermodynamics, appropriate modeling approximations as well as proper property relations and evaluation.

Format: **Solutions in pencil. Each problem starts on a separate page, 8.5 x11, with all pages stapled together.**

1. **K**nown: Input: A brief summary of the problem, "in your own words"., include known values, constraints , other useful data.
2. **F**ind: Output Quantities to be determined.
3. Characteristics: What are the characteristics of the problem.
4. **S**ketch: **An energy diagram.** Properly labeled and indicated- **physical system transfer directions and in addition property diagrams**
5. **A**ssumptions: Modeling assumptions that are used in solving the problem are listed and clearly indicated as a constraint. (User needs to know its limitations)
6. **P**roperties: Substance identified and needed properties, value with units **and source of data**.
7. **A**nalysis: The problem is solved in a systematic and logical manner, showing all steps, include **stating modeling assumptions** as needed, **starting from the fundamental equation(s)** from which the analysis begins [and numerical values (with units) are shown]. Final results clearly indicated.
8. **D**iscussion: Evaluate : Any comments relative to the resulting equations , results, effects, validity of assumptions, etc. are

Quizzes- There could be periodic, short quizzes covering assigned problems and lecture material. Any missed quiz will be recorded as a grade of zero, there will be no make-up .

Tests. Generally 3-4 problems which are similar to the **Class problems, Text Problems, HW, or Short quiz** Problems. Tests stress the following levels**: knowledge, comprehension, application, and analysis . The tests are graded accordingly. Format for tests is the same as that for homework.**

Attendance: You are expected to attend all classes, **act in a professional, non-disruptive manner 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 (water) and refrigerant 134-a, and ideal gases from either tabular data or equations of state**.
   - Use absolute, gage, and vacuum pressures correctly.
   - Calculate pressures under static conditions .
   - 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.
   - Correctly apply the ideal gas approximation 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 (and displacement 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.

3a 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.
   - Determine the coefficient of performance of refrigerators and heat pumps and compare with 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.

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

Dr. Florio's office "Hour" is 45 minutes before classes.