Fall 2023: ME311 Thermodynamics I

Instructor: Dr. Yufeng Song
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Class: Days/Times –Wednesday (6:00 PM – 9:00 PM);
KUPF 118, Credits – 3.00

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

Prerequisites: Math 211- Calculus 111; Phys 111-Physics 1

Textbook: Thermodynamics – An Engineering Approach, 8th or 9th edition, by Cengel and Boles, McGraw-Hill publisher

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.

Course Syllabus

Week	Topic	Chapter
1 & 2 (09/06) & 09/13)	**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	**1**
3 & 4 (09/20 & 09/27)	**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	**2**
5 & 6 (10/4 & 10/11)	**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	**3**
7 (10/18)	**Test 1**	
7 & 8 (10/18 & 10/25)	**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	**4**
9 & 10 (11/01 & 11/08)	**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	**5**
11 (11/15)	**Test 2**	
11 & 13 (11/15 & 11/29)	**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	**6**
14 & 15 (12/06 & 12/13)	**Entropy** Entropy, The Increase of Entropy Principle, Entropy Change of Pure Substances, Isentropic Processes, Property Diagrams Involving Entropy, What Is Entropy? The T ds 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	**7**
16 (12/20)	**FINAL EXAM**	

EVALUATION SCHEME:

Your course grade will be determined as follows:

• Homework	10 %
• Attendance and Class Participation	5 %
• 5 Quizzes	25 %
• Test 1	20 %
• Test 2	20 %
• Final Exam	20 %

TENTATIVE GRADING SCHEME:

Letter Grade	Total Weighted Mark
A	> 90
B+	85-89.9
B	80-84.9
C+	75-79.9
C	70-74.9
D	60-69.9
F	< 60