

**ME 211 THERMODYNAMICS I**  
**SYLLABUS-Fall 2017**

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## **1 Introduction**

- 1.1 A Thermodynamic System and the Control Volume
- 1.2 Macroscopic versus Microscopic Points of View
- 1.3 Properties and State of a Substance
- 1.4 Processes and Cycles
- 1.5 Units for Mass, Length, Time and Force
- 1.6 Specific Volume and Density
- 1.7 Pressure
- 1.8 Energy
- 1.9 Equality of Temperature
- 1.10 The Zeroth Law of Thermodynamics
- 1.11 Temperature scales
- 1.12 Engineering Applications

## **2 Pure Substance Behavior**

- 2.1 The Pure Substance
- 2.2 The Phase Boundaries
- 2.3 The P-v-T Surface
- 2.4 Tables of Thermodynamic Properties
- 2.5 The Two-Phase States
- 2.6 The Liquid and Solid States
- 2.7 The Superheated Vapor States
- 2.8 The Ideal Gas States
- 2.9 The Compressibility Factor
- 2.10 Equations of State
- 2.11 Computerized Tables
- 2.12 Engineering Applications

## **3 First Law of Thermodynamics and Energy Equation**

- 3.1 The Energy Equation
- 3.2 The First Law of Thermodynamics
- 3.3 The Definition of Work
- 3.4 Work Done at the Moving Boundary of a Simple Compressible System
- 3.5 Definition of Heat
- 3.6 Heat Transfer Modes
- 3.7 Internal Energy---a Thermodynamic Property
- 3.8 Problem Analysis and Solution Technique
- 3.9 The Thermodynamic Property Enthalpy
- 3.10 The Constant-Volume and Constant-Pressure Specific Heats

- 3.11 The Internal Energy, Enthalpy, and Specific Heat of Ideal Gases
- 3.12 General Systems That Involve Work
- 3.13 Conservation of Mass
- 3.14 Engineering Applications

#### **4 Energy Equation for a Control Volume**

- 4.1 Conservation of Mass and The Control Volume
- 4.2 The Energy Equation for a Control Volume
- 4.3 The Steady-State Process
- 4.4 Examples of Steady-State Processes
- 4.5 Multiple Flow Devices
- 4.6 The Transient Process
- 4.7 Engineering Applications

#### **5 The Classical Second Law of Thermodynamics**

- 5.1 Heat Engines and Refrigerators
- 5.2 The Second Law of Thermodynamics
- 5.3 The Reversible Process
- 5.4 Factors That Render Processes Irreversible
- 5.5 The Carnot Cycle
- 5.6 Two Propositions Regarding the Efficiency of a Carnot Cycle
- 5.7 The Thermodynamic Temperature Scale
- 5.8 The Ideal-Gas Temperature Scale
- 5.9 Ideal Versus Real Machines
- 5.10 Engineering Applications

#### **6 Entropy for a Control Mass**

- 6.1 The Inequality of Clausius
- 6.2 Entropy—a Property of a System
- 6.3 The Entropy of a Pure Substance
- 6.4 Entropy Change in Reversible Processes
- 6.5 The Thermodynamic Property Relation
- 6.6 Entropy Change of a Solid or Liquid
- 6.7 Entropy Change of an Ideal Gas
- 6.8 The Reversible Polytropic Process for an Ideal Gas
- 6.9 Entropy Change of a Control Mass During an Irreversible Process
- 6.10 Entropy Generation and the Entropy Equation
- 6.11 Principle of the Increase of Entropy
- 6.12 Entropy as a Rate Equation
- 6.13 Some General Comments about Entropy and Chaos

#### **7 Entropy Equation for a Control Volume**

- 7.1 The Second Law of Thermodynamics for a Control Volume
- 7.2 The Steady-State Process and the Transient Process
- 7.3 The Steady-State Single-Flow Process

- 7.4 Principle of the Increase of Entropy
- 7.5 Engineering Applications—Efficiency
- 7.6 Summary of General Control Volume Analysis

## **8 Exergy**

- 8.1 Exergy, Reversible Work, and Irreversibility
- 8.2 Exergy and Second-Law Efficiency
- 8.3 Exergy Balance Equation
- 8.4 Engineering Applications