1. Title: 155:208 Chemical Engineering Thermodynamics I

2. 3 credits and 3 contact hours

3. Instructor's name: M. Hara Teaching Assistant: Apostolos Zournas

4. Text book: M. D. Koretsky, "Engineering and Chemical Thermodynamics," 2nd Ed., J. Wiley & Sons Inc., (2013).

5. Specific course information
    a. Brief description of the content of the course (catalog description): Thermodynamics relates work, heat, temperature, and states of matter to each other. From a surprisingly small set of empirically based laws, an enormous amount of information about the relationships among equilibrium parameters for a system can be deduced. This information can then be applied to physical, chemical, and biological systems including chemical process design, materials processing, and cellular processes.

    b. Prerequisites: 155:201
    c. This is a required course in the program

6. Specific goals for the course
    a. Specific outcomes of instruction: The students should understand the 1st and 2nd laws of thermodynamics and apply them to solve problems. 2. The students should be able to apply energy balances to open and closed systems and to evaluate the thermodynamic efficiency of Rankine cycles and refrigeration cycles. 3. They should be able to use equations of state to solve problems. 4. They should be able to derive property relationships using multivariable calculus and be comfortable using steam tables and generalized charts for compressibility factor, enthalpy, and entropy.
    b. The achievement of outcomes (a), (e), and (k) will be addressed in this course: Outcome (a) - an ability to apply knowledge of mathematics, science, and engineering. Equations and models used are derived from the laws and fundamental relations of thermodynamics; Outcome (e) - an ability to identify, formulate and solve engineering problems. Systematic analysis has been applied for the solution of complex situations; Outcome (k) - an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

7. Brief list of topics to be covered

    0. Introduction

    1. Basic Concepts 1.1,1.2
        Properties
            Extensive/Intensive, 1.3

Dependent/Independent	1.5
Equilibrium	1.4
P-V-T properties of pure substances, property tables	1.6, 1.7
The Ideal Gas Law	1.3

2. First Law of Thermodynamics

Heat & work	2.1
Reversible & irreversible processes	2.3
The First Law of Thermodynamics (closed system)	2.4, 2.7
Internal energy, Enthalpy, Heat capacity	2.6
The First Law of Thermodynamics (open system)	2.5, 2.8
Latent heat, Enthalpy of reactions	2.6
Thermodynamic cycles	2.9

3. Entropy & Second Law of Thermodynamics

Directionality & spontaneity of processes	3.1
Reversibility/Irreversibility	3.2
Entropy	3.3
The Second Law of Thermodynamics	3.4, 3.5
The Second Law of Thermodynamics (closed system)	3.6, 3.7
The Second Law of Thermodynamics (open system)	3.6, 3.7
The Rankine cycle, Refrigeration cycle	3.9

4. Equations of State

Intermolecular forces	4.2
Internal energy, Attractive & repulsive forces	
Ideal gas equation of state	4.1
Principle of corresponding states	4.2
Equations of State	4.3
van der Waals equation of state	
Cubic equations of state	
Virial equation of state	
Generalized compressibility charts	4.4

5. Thermodynamic Property Relationships

Measured, fundamental, derived properties	5.1
Fundamental property relations	5.2
Thermodynamic web	5.2
Calculations of properties	5.3
Departure functions	5.4
Joule-Thomson expansion and Liquefaction	5.5