1. MME 3308 Applied Thermodynamics

2. 3 credits and 3 contact hours per week

3. Namsoo Peter Kim

4. Gaskell, "INTRODUCTION to the THERMODYNAMICS of MATERIALS," Taylor & Francis, 5^{th} edition

5. Specific course information
    a. First, second, and third law of thermodynamics applied to materials systems. Topics include thermochemistry, chemical equilibria, phase equilibria, solutions, activity, and electrochemical potentia.
    b. MME 2305, with a grade of "C" or better.
    c. Required course

6. Specific goals for the course include the following learning outcomes.
    a. Specific Learning Outcomes
        - Apply the concepts of energy, Isothermal expansion, reversible, adiabatic expansion, constant pressure processes & volume processes, ΔU, ΔH, q, and w, to determine the maximum work and heat added to or removed from the system. (Exam I)
        - Describe the 1^{st} and 2^{nd} Law statement, Carnot Cycle, the statistical Entropy and calculate ΔS^{Mixing} Stirling's Approximation, the Maxwell Relations, the criterion of equilibrium for systems at constant T and P (Exam I and II)
        - Apply the Clausius and the Clausius-Claperyon Equations to calculate the T and determine the K_{eq} for a reaction from $\Delta G°$ and analyze the equilibrium state (partial pressures, moles) for a reaction Exam Ii)
        - Apply the absolute relative and partial Integral molar quantities, ideal solutions, excess Quantities, Gibb's Duhem Equation, Tangent Intercept Method to analyze the materials and energy balance (Exam II & III)
        - Analyze the activities and activity coefficients and calculate the cell potential for electrolytic cells involving dissolved components using Eh-pH Diagram or the Ellingham Diagram (Exam III)

    b. Student Outcomes addressed by the course: Outcome 1 emphasized at a high level.

7. Brief list of topics to be covered
        - First Law of Thermodynamics (5 classes)
        - Forms of Energy, Heat and Work, Joules Experiments, Conservation of Energy, Concept of Maximum Work, Isothermal Expansion, Reversible,

Adiabatic Expansion, Constant Pressure Processes, Constant Volume Processes, Enthalpy

- Second Law of Thermodynamics (4 classes)
- 2nd Law Statement, Carnot Cycle, 2 Propositions
- Statistical Entropy (1 classes)
- Physical Meaning of Entropy, Boltzman Equation, Mixing Entropy, Stirling's Approximation
- Auxiliary Functions (1 classes)
- Fundamental Equations of State, Maxwell Relationships, Other Thermodynamic Relations, Chemical Potential, Gibbs-Helmholtz Equation, Criteria of Equilibria
- Heat Capacity and Entropy Changes (2 classes)
- Phase Equilibria in One Component Systems (1 classes)
- Clausius-Claperyon Equation, Heats of Vaporization From Vapor Pressure Data, Shift in Transformation Temperature with Pressure
- The Behavior of Gases (1 classes)
- Compressibility Factor, Law of Corresponding States, Equations of State, Fugacity
- Reactions Equilibria (8 classes)
- Equilibria in Gaseous Systems, The Equilibrium Constant and DG°, Reaction Extent Problems, Equilibria in Systems Containing Condensed Phases, Ellingham Diagram, Activities,
- Solution Thermodynamics (3 classes)
- Phase Equilibria and Electrochemistry (as time permits)