*DEPARTMENT OF CHEMICAL ENGINEERING*

**Syllabus**

**CHE 22900: Chemical Engineering Thermodynamics I**

**Designation:** Required course

**Catalogue Description:** Basic concepts and definitions. Energy and the first law. Entropy and the second law. Pure component thermodynamics and the fundamental property relation. Thermodynamics of processes. Availability. Physical Equilibrium. Introduction to microscopic thermodynamics. The third law.

**Prerequisites:** Chem 10400, Phys 20700 (min. C)
**Co-requisites:** Math 39100

**Text:** "Introductory Chemical Engineering Thermodynamics", J. R. Elliott & C. T. Lira, Prentice Hall PTR, 1999. (Amazon.com: $85, CCNY bookstore: ~$81.25)
ChE 22900 will cover *Chapters 1-6*. Chapters 7 and higher will be covered in ChE 33000 Chemical Engineering Thermodynamics II.

**Course Objectives:**
After completing this course, students should

1) Be able to apply fundamental thermodynamic terms (e.g., absolute temperature, sink/reservoir, intensive/extensive, phase rule, superheated, open/closed system, critical point/temperature/pressure, quality, saturation temperature/pressure, isobar, isotherm, isochore, phase diagram, flow work, shaft work)
2) Be able to use/apply steam tables and do single/double interpolation given (1) P,T; (2) P, H including interpolation between saturation tables and superheated tables.
3) Be able to computationally relate quality to overall molar or specific properties.
4) Be familiar with the concept of enthalpy.
5) Be able to explain the importance of assuming reversibility in making engineering calculations of work.
6) Calculate work and heat flow for an ideal gas along isotherm, isochore, and adiabatic pathways.
7) Be thoroughly familiar with the concepts of entropy and reversibility.
8) Be able to simplify and combine the general energy and entropy balances to solve given textbook and homework problems.
9) Be able to sketch and read P-H and T-S diagrams.
10) Be able to calculate inlet and outlet states of reversible process equipment
11) Be able to apply thermodynamic concepts and principles to process cycles.
12) Be able to derive Maxwell relations and use them to interchange derivatives as well as manipulate partial derivatives.
13) Be familiar with the concepts of equation of state, compressibility factor, acentric factor

**Topics Covered:**

1) Basic Concepts
2) First Law of Thermodynamics

3) Concept of Entropy
4) Second Law of Thermodynamics
5) Multistage Processes
6) Carnot Cycle
7) Rankine Cycle
8) Refrigeration & Liquefaction
9) Miscellaneous Process Thermodynamics
10) Derivatives
11) Equation of State

**Course Schedule:** This class meets twice a week for a total of three academic hours over a fourteen-week semester. Out-of-class assignments (9 per semester) stress problem solving capability. Three in-class exams that include essay questions to test overall comprehension of the material. Grading: Assignments – 25%, in-class exams – 50%, final exam – 25%.

**Contribution of course to meeting the professional component**:
This is a core subject for Chemical Engineering. The primary purpose of the course is to provide the student with a mastery of the fundamental concepts and applications of thermodynamics as related to unit operations and unit processes.

**Relationship of course to program outcomes:**
The outcomes for this course contribute to the following departmental educational outcomes:

a. an ability to apply knowledge of mathematics, science, and engineering
e. an ability to identify, formulate, and solve engineering problems
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
i. a recognition for the need for, and an ability to engage in life-long learning

**Instructor (person who prepared this description) and date of preparation.**
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