DEPARTMENT OF CHEMICAL ENGINEERING

Syllabus

CHE 33000: Chemical Engineering Thermodynamics II

Designation: Required course for Chemical Engineering Juniors

Catalogue Description*:* Partial molar quantities. Thermodynamics of solutions. Activities and fugacities. Modeling of thermodynamic parameters. Chemical reaction equilibrium. The free energy minimization procedure for complex chemical reactions.

Prerequisites: ChE 22800, ChE 22900, Math 39100
Co-requisites: none

Text: "Introductory Chemical Engineering Thermodynamics", J. R. Elliott & C. T. Lira, Prentice Hall PTR, 1999. (Amazon.com: $85, CCNY bookstore: ~$81.25)
ChE 33000 will cover *Chapters 7-12,14,15*..

Course Objectives:
After completing this course, students should

1) Be familiar with the concepts of equation of state, compressibility factor, acentric factor
2) Be able to use and apply departure functions.
3) Be able to use the Antoine equation to calculate saturation temperature and pressure.
4) Be familiar with the concept of fugacity.
5) Be able to sketch and read P-x-y and T-x-y diagrams.
6) Be able to identify systems where Raoult's law applies.
7) Be able to write the criteria for VL phase equilibria using an equation of state for both phases and rearrange the expression to give the VLE K-ratio in terms of variables.
8) Be able to describe azeotropic behavior and be able to identify if an azeotropic phase diagram has the correct appearance.
9) Be able to write the equilibria criteria using fugacities and activities.
10) Be able to calculate the LLE K-ratios using activity coefficients.
11) Be thoroughly familiar with concepts of mole fraction and mole balances.
12) Be able to explain and apply the LeChatelier's principle.
13) Be familiar with the concept of molecular association.

Topics Covered:

1) Departure Functions
2) Phase Equilibrium
3) Raoult's Law
4) Non-ideal Mixtures
5) Emission Calculations
6) Activity Models
7) VLE by EOS
8) Liquid-Liquid Equilibrium
9) Reacting Systems

10) Multi-Reaction Equilibrium
11) Association and Solvation

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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