

ChE 3063 Equilibrium Thermodynamics

(Required course for ChE program)

Current Catalog Description: Application of equilibrium thermodynamics to chemical engineering systems with emphasis on non-ideal behavior in chemical reactions, fluid flow, and vapor-liquid equilibrium.

Co-requisites: none

Prerequisites: ES 3053 (Thermodynamics), ChE 2003 (Stoichiometry).

Prerequisites by Topic: Laws of thermodynamics, mass and energy balances, Excel and Visual Basic programming

Recent Textbook: J. M. Smith, H. C. Van Ness, and M. M. Abbott, "Introduction to Chemical Engineering Thermodynamics", McGraw-Hill, 7th Edition, 2001, ISBN 0-07-310445-2.

Other Required Material: None

Course Objectives: By the end of the semester, the students will be able to:

1. Determine the properties of pure substances using charts and equations, including departures from ideal gas.
2. Determine the properties of ideal and non-ideal mixtures using both charts and equations.
3. Test experimental data for thermodynamic consistency.
4. Determine phase equilibrium and phase changes of mixtures, include bubble points, dew points, flashes, and liquid-vapor phase diagrams using modern computing tools where appropriate.
5. Determine equilibrium concentrations for single and multiphase reactive systems.

Major Topics Covered in the Course : Pure component properties; pure component phase equilibria; properties of ideal and nonideal mixtures; multicomponent phase equilibria; reaction equilibria; tests

Class/Laboratory Schedule: Lecture meets for three 50-minute sessions each week for 14 weeks

Professional Component Contribution: This course applies mathematics, chemistry and physics to engineering applications of chemical thermodynamics. Computer skills are extended in this course to numerical solution of nonlinear equations. A minimum of one design problem is assigned in this course. Throughout the course, safety and ethics are briefly emphasized.

Relationship to Student Outcomes	
outcome:	Description of related course content:
(a) an ability to apply knowledge of mathematics, science and engineering	The course requires use of differential and integral calculus to solve engineering problems. Numerical methods for solving nonlinear equations and systems of nonlinear equations are taught. Problems in this course build on a background of chemistry, physics and thermodynamics.
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	
(d) an ability to function on multi-disciplinary teams	
(e) an ability to identify, formulate, and solve engineering problems	Homework problems are assigned each week so that students will develop the necessary problem solving skills.
(f) an understanding of professional and ethical responsibility	
(g) an ability to communicate effectively	
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	
(i) a recognition of the need for, and an ability to engage in life-long learning	
(j) a knowledge of contemporary issues	
(k) an ability to use the techniques, skills and modern engineering tools necessary for engineering practice	Students are required to use computers to solve homework problems throughout the course, particularly in Excel language and Excel combined with Visual Basic. Hand calculations are strongly discouraged by the instructor.

Prepared by: Kraemer Luks (November 1, 2006)

Objectives modified by: Kraemer Luks (April 26, 2007; April 29, 2008)

New course objectives from Spring 2009 added by G. L. Price

Modified 3/20/2012 to remove old ChE criteria - GLP