

Catalog Description:

A continuation of CHE 222 with emphasis on the second and third laws of thermodynamics. Emphasis on thermodynamic properties of fluids, flow processes, phase and chemical equilibria.

Prerequisite Courses: ChE 222

Prerequisite Knowledge:

- College level calculus
- Application of the First Law of Thermodynamics and other basic concepts (enthalpy, internal energy, volumetric work/shaft work etc) in closed or open systems
- PVT behavior of pure substances/Equation of State/Generalized Correlations
- Phase equilibrium of pure substances/ the phase rule
- Entropy and the Second Law of Thermodynamics/Reversibility

Course Objectives:

- To enhance the knowledge of fluid thermodynamics with the emphasis on application and develop a clear understanding and working knowledge of solution thermodynamics and the theories of fluid phase and chemical reaction equilibria.

Expected Outcomes: After completion of this course the typical student is expected to be able to:

- Evaluate changes in thermodynamic properties (P, V, T, U, H, S and G) caused by mixing of various substances without phase change
- Evaluate fugacity and fugacity coefficient of pure species and species in solution
- Perform various phase equilibria calculations (equilibrium composition of liquid and vapor phases, dew/bubble point and L/V ratio, solid-liquid, liquid-liquid mixtures) using the Gamma/Phi formulation and a variety of its simplifications
- Evaluate the chemical equilibrium constant for a specific reaction. Express the phase composition as a function of reaction extent for single/multiple reactions and homogeneous/heterogeneous reactions and evaluate the equilibrium reaction extent
- Analyze the shift of chemical reaction equilibria associated with the change in reaction conditions.
- Use the AspenPlus process simulator to correctly setup and obtain thermodynamic properties for various systems.

Time/Place: CB 108, MWF 1:00 pm - 1:50 pm

Instructor: Dr. Jason C. Hower
EEP 119, 394-2627 (w), Jason.Hower@sdsmt.edu

Office hours: MWF 11 am – 12:00 pm, or by appointment.

Text: Koretsky, “**Engineering and Chemical Thermodynamics**”, Wiley, 2004

Reference: Smith/Van Ness/Abbott, “**Introduction to Chemical Engineering Thermodynamics**”, 7th ed., McGraw Hill, 2005

Grading:

<u>Item</u>	<u>Points</u>
Exams (2)	40
Final Exam*	(30)
Homework**	15
Quizzes***	10
<u>Feedback</u>	<u>5</u>
Total	100

Tentative grade scale **:**

<u>Points earned</u>	<u>Grade</u>
90	A
80-89	B
70-79	C
60-69	D
<60	F

- * The Final will be a 2-hour comprehensive exam. All exams will be open textbook and open notes. .
- ** Homework will only be accepted electronically via the [D2L course website](#). I encourage you to use a program like Windows Journal on your tablet. If you chose to you may scan in paper work. However, if you chose to take notes and do homework on your tablet, you will best be able to participate in class activities. No late homework will be accepted. Submitted homework must be clean, readable, logically sound and prepared as if any CBE professional could grade even without the problem or text.
- *** Approx. one per week on Fridays. Open book/note No calculator, drop the lowest score
- ****The final grade will be reflective of a student's rank in the class as well as the cumulative points earned.

Topics to Be Covered:Chapter 4

- Review of Equations of State; introduction to mixing rules

Chapter 5

- Thermodynamic Web
- Departure Functions
- J.T. Cooling

Chapter 6

- Equilibrium
 - * Pure Component
 - * Mixtures

Chapter 7

- Fugacity
 - * Vapor, liquid, solids
- Fugacity Coefficients
- Activity Coefficients

Chapter 8

- Phase Equilibrium
 - * Diagrams
 - * Vapor – Liquid (VLE)
 - * Liquid – Liquid (LLE)
 - * Solid – Liquid (SLE)

Chapter 9

- Reaction Equilibria

Finals

14 December 2-4pm

Students with special needs or requiring special accommodations should contact the instructor, Dr. Jason Hower at 394-2627 and/or the campus ADA coordinator, Ms. Jolie McCoy, at 394-1924 at the earliest opportunity.

Under Board of Regents and University policy student academic performance may be evaluated solely on an academic basis, not on opinions or conduct in matters unrelated to academic standards. Students should be free to take reasoned exception to the data or views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled. Students who believe that an academic evaluation reflects prejudiced or capricious consideration of student opinions or conduct unrelated to academic standards should contact the dean of the college which offers the class to initiate a review of the evaluation.