CENG 210S Introduction to Chemical Engineering

Classroom: ML 107
Class schedule: MWF 9:00-11:15

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Office hours: Monday afternoon

Objectives:

This is a rigorous introductory course in chemical engineering. Students will be introduced to the chemical engineering profession and will gain engineering practice, including the fundamentals of design and analysis.

Text:

Chemical Engineering Design and Analysis by T. Michael Duncan & Jeffrey A. Reimer, Cambridge University Press, ISBN 9780521639569

Exams and problem sets:

4 non-cumulative tests, 20% each (dates to be announced)
weekly problem sets, 20%

Note about problem sets and tests:

Test problems will be drawn from the problem sets.

Topics

1. Heat, work, internal energy, entropy; extensive properties, intensive properties; fundamental equations, equations of state; temperature, mechanical equilibrium, chemical equilibrium.

   Callen: Chapters 1,2

2. Euler equation, Gibbs-Duhem relation; heat capacity, compressibility, coefficient of thermal expansion; specific systems: ideal gas, van der Waals fluid.

   Callen: Chapter 3

3. Feasible processes, maximum work theorem; cyclic processes: heat engines, refrigerators, heat pumps, efficiency; Carnot cycle, endoreversible engines, other cyclic processes.

   Callen: Chapter 4

4. Legendre transformations: Helmholtz, enthalpy, Gibbs, and Massieu functions, extremum principle; Maxwell relations.

   Callen: Chapters 5, 6, 7.

5. Stability. Phase equilibrium in single- and multicomponent systems, phase rule, phase diagrams. Chemical reactions, imperfect gases.

   Callen: Chapters 8, 9, 13. Denbigh: Chapters 7,8,9

6. ~~Statistical mechanical ensembles and thermodynamics.~~

   ~~Hill: Chapter 1.~~

1.	M July 4	Callen, Ch. 1
2.	W July 6	Callen, Ch. 2
3.	F July 8	Callen, Ch. 3
4.	M July 11	Callen, Ch. 4.1-4.5
5.	W July 13	Callen, Ch. 4.6-4.10, Ch. 5
	Problem set 1 due	
6.	F July 15	Callen, Ch. 6.1-6.3
	Test 1 (4:00pm Callen, Ch. 1-3, Problem set 1)	
7.	M July 18	Callen, Ch. 6.4, 7.1-7.2
8.	W July 20	Callen, Ch. 7.3
	Problem set 2 due	
9.	F July 22	Callen, Ch. 8.1-8.3
	Test 2 (4:00pm Callen, Ch. 4-6.3, Problem set 2)	
10.	M July 25	Callen, Ch. 8.4, 8.5
11.	W July 27	Callen, Ch. 9.1-9.7
	Problem set 3 due	
12.	F July 29	Callen, Ch. 13.5, Denbigh Ch. 8-9
	Test 3 (3:00pm Callen, Ch. 6.4,8.1-8.3, 13.2, Problem set 3)	
13.	M August 1	Phase equilibrium problems
14.	W August 3	Phase equilibrium problems
	Problem set 4 due	
15.	F August 5	
	Test 4 (9:00am Callen, Ch. 8.4, 8.5, 9, 13.5; Denbigh Ch. 8-9 (lecture notes), Problem set 4)	