CENG 210S Introduction to Chemical Engineering

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

Instructor: Michael Loewenberg  
Office: 303 Mason Lab  
Email: michael.loewenberg@yale.edu  
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:


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.


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


   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 (9:00am 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)