CENG S300 Chemical Engineering Thermodynamics

Class schedule: MW 9:00am-11:15am
Instructor: Michael Loewenberg
Email: michael.loewenberg@yale.edu
Office hours: M 1:00-3:00pm

Teaching Fellow: Rodrigo Reboucas
Email: Rodrigo.Reboucas@yale.edu
Office hours: M 5:00-7:00pm
Objectives:

This is a rigorous introductory course in thermodynamics. Material will include the first and second laws of thermodynamics, cyclic processes, and chemical reaction and phase equilibria. The goal of this course is for students to obtain the necessary qualitative knowledge and quantitative skills for solving engineering science problems in thermodynamics.

Prerequisites: Multivariable calculus, high school chemistry.

Texts:


   https://archive.org/details/ThePrinciplesOfChemicalEquilibrium

Exams, homework, and in-class work
4 non-cumulative weekly tests¹, 15% each
4 weekly problem sets, 20%
class participation, 20%

Class Website
Log in to the Yale Canvas website with your netID to access lecture videos and lecture notes, problem sets and reading assignments, and other handouts.

Course Expectations
Classes (and active class participation) is essential for learning how to setup and solve the assigned problems. You will be expected to study online course materials (watch videos, read lecture notes and assigned readings) in advance of each class. Collaboration on problem sets is encouraged. The weekly tests are closed book and closed notes.

¹ Test problems will be similar to problems on weekly problem sets
Syllabus

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

Class 1  M 9:00-11:15am
Class 2  W 9:00-11:15am

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

Class 3  M 9:00-11:15am
Problem set 1 due  M midnight
Class 4  W 9:00-10:00am
**Test 1**  W 10:00-11:15am

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

Class 5  M 9:00-11:15am
Problem set 2 due  M midnight
Class 6  W 9:00-10:00am
**Test 2**  W 10:00-11:15am

Week 4:

Class 7  M 9:00-11:15am
Problem set 3 due  M midnight
Class 8  W 9:00-10:00am
**Test 3**  W 10:00-11:15am
**Week 5:**
Phase equilibrium in single- and multicomponent systems, phase rule, phase diagrams.

- **Class 9**: M 9:00-11:15am
- **Problem set 4 due**: M midnight
- **Class 10**: W 9:00-10:00am
- **Test 4**: W 10:00-11:15am