CENG S300E Chemical Engineering Thermodynamics

Instructor: Michael Loewenberg  
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Class schedule: 6:30-8:00pm MWF

Teaching Fellow: Atsu Kludze  
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Recitation: M 8:30-10:00pm, optional (starting in week 2)

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:


Exams, homework, and in-class work

2 tests, 30% 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 tests are closed book and closed notes.
Syllabus

Week 1: July 1-5

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

Class 1 M 6:30-8:00pm
Class 2 W 6:30-8:00pm
Class 3 F 6:30-8:00pm

Week 2: July 8-12

Problem set 1 due W 11:59pm

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

Class 4 M 6:30-8:00pm
Recitation M 8:30-10:00pm
Class 5 W 6:30-8:00pm
Class 6 F 6:30-8:00pm

Week 3: July 15-19

Problem set 2 due W 11:59pm

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

Class 7 M 6:30-8:00pm
Recitation M 8:30-10:00pm
Class 8 W 6:30-8:00pm
Test 1 F 6:30-8:00pm

Week 4: July 22-26

Problem set 3 due W 11:59pm


Class 9 M 6:30-8:00pm
Recitation M 8:30-10:00pm
Class 10 W 6:30-8:00pm
Week 5: July 29- August 2
Problem set 4 due W 11:59pm

Phase equilibrium in single- and multicomponent systems, phase rule, phase diagrams.

Class 12  M 6:30-8:00pm
Recitation  M 8:30-10:00pm
Class 13  W 6:30-8:00pm
Test 2  F 6:30-8:00pm