University of Hawaii at Manoa
Department of Mechanical Engineering

ME 612 Introduction to Statistical Thermodynamics (3 Credits) Fall 2018

Instructor
Yi Zuo   Email: yzuo@hawaii.edu
Office: POST-207C   Phone: 956-9650
Office Hours: Tuesday 3-4 pm or by appointment

Course description
This course introduces fundamentals of statistical thermodynamics. Main topics include entropy, Boltzmann law, thermodynamic driving forces, Maxwell relations, statistical mechanics, chemical equilibria, solutions and mixtures, and applications of statistical thermodynamics in biology, chemistry, physics, and nanoscience. By the end of this course, students are expected to gain basic knowledge about statistical thermodynamics.

Prerequisites
ME 311 or ME 611 or instructor's consent.

Schedule
TH 1:30-2:45 pm   Classroom TBD

Textbooks (Required)

Supplemental textbooks

Exams and grading
- Homework 30%
- Midterm exam 30%
- Term project (class presentation) 20%
- Term project (written report) 20%
Topics to be covered

Part I. Fundamental Thermodynamics

Chapter 0. Review of Classical Thermodynamics
Chapter 4. Math Tools: Multivariate Calculus
Chapter 6. Thermodynamics Driving Forces
Chapter 7. The Logic of Thermodynamics
Chapter 8. Laboratory Conditions and Free Energies
Chapter 9. Maxwell’s Relations and Mixtures

HW#1. Fundamental Thermodynamics

Part II. Statistical Thermodynamics

Chapter 1. Principles of Probability
Chapter 2. Extremum Principles Predict Equilibrium
Chapter 3. Heat, Work, and Energy
Chapter 5. Entropy and the Boltzmann Law
Chapter 10. The Boltzmann Distribution Law

HW#2. Fundamental Statistical Thermodynamics

Part III. Applications in Biology, Chemistry, Physics and Nanoscience

Chapter 14. Equilibria between Liquids, Solids, and Gases
Chapter 15. Solutions and Mixtures
Chapter 16. Solvation and the Transfer of Molecules between Phases

HW#3. Applied Statistical Thermodynamics

* The following chapters will be covered only when time permits.

Chapter 11. The Statistical Mechanics of Simple Gases & Solids
Chapter 12. What is Temperature? What is Heat Capacity?
Chapter 13. Chemical equilibria

Chapter 24. Intermolecular Forces
Chapter 25. Phase Transitions
Chapter 29. Bio and Nano Machines
Chapter 30. Water
Chapter 31. Water as a Solvent