University of Wisconsin-Madison
Chemistry 864. Statistical Mechanics
Spring 2018 Syllabus

Instructor: Professor A. Yethiraj, 8305B Chemistry, 608 262 0258, Office hours: By appointment

Canvas Course URL https://canvas.wisc.edu/courses/76310

Instructional mode: face-to-face

Course Description: Fundamentals of statistical mechanics; applications to equilibrium and non-equilibrium properties of gases and condensed phases; selected advanced topics.
Requisite: Graduate or professional standing

How Credit Hours are Met: This class meets for thirty 50-minute lectures over the course of the semester. Students enrolled for two credits are expected to do at least 90 hours of learning activities, which includes class attendance, reading, studying, preparation, problem sets, and other learning activities. Students enrolled for three credits will have an additional 45 hours of outside class work and meetings with the instructor related to their term project.

Grading: One mid-term exam (100 points), 5 problem sets (10 points each), and one final exam (200 points). Course graded on a curve with an AB average.

Learning outcomes: Students are expected to be able to read the literature in statistical mechanics, develop models for common experimental systems, and perform mean-field calculations for these models. In addition, students will learn fundamental aspects of the following topics:

- Classical equilibrium statistical mechanics: Review of distribution functions, structure of liquids, x-ray and neutron scattering, computer simulation methods.

- Phase behavior: Ising model, mean-field theory, thermodynamic perturbation theory, liquid-liquid and liquid-vapor phase transitions, critical phenomena.

- Dynamics of classical systems: Random walks, Brownian motion, Langevin and generalized Langevin equations, rate processes in condensed matter.

Useful reading material:
D. A. McQuarrie, Statistical Mechanics (Harper & Row, 1976)
D. Chandler, Introduction to Modern Statistical Mechanics (Oxford, 1987)
T. L. Hill, An Introduction to Statistical Thermodynamics (Dover, 1986).

J.-P. Hansen and I. R. McDonald, Theory of Simple Liquids, (Acad, 1986)
U. Balucani and M. Zoppi, Dynamics of the Liquid State (Oxford, 1994)
H. L. Friedman, A Course in Statistical Mechanics (Prentice-Hall, 1985)
R. Zwanzig, Nonequilibrium Statistical Mechanics (Oxford, 2001)
N. Goldenfeld, Lectures on Phase Transitions and the Renormalization Group (Addison-Wesley, 1992)