CE 235 / ME 279 – Statistical Mechanics of Elasticity

Instructor: Prof. Sanjay Govindjee, 779 Davis Hall, E-mail: s_g@berkeley.edu. Office Hours: MTu 1-2:30, W 11-12

GSI: None.

Web: See bspace; material from prior offerings can be found at

- http://www.ce.berkeley.edu/~sanjay/statmech
- http://www.ce.berkeley.edu/~sanjay/ce235me279 .

Required Textbook: [On reserve in library]

- J.H. Weiner, *Statistical Mechanics of Elasticity*, 2002 (other editions ok).

Other useful books: [On reserve in library]

- J.W. Gibbs,*Elementary Principles in Statistical Mechanics* 1901 (original), 2008 (most recent printing).
- A.I. Khinchin, *Mathematical Foundations of Statistical Mechanics* 1960.
- D. Chandler, *Introduction to Modern Statistical Mechanics* 1987.
- F. Reif, *Fundamentals of Statistical and Thermal Physics* 1965 (original), 2008 (most recent printing).

Conduct of Course: Homework will be assigned weekly and due the following the week (on Fridays).

There will be one midterm examination (take home) and a final project.

Course grade is based on: Homework 30%, Midterm 30%, Final Project 40%.

Rough Outline:

Topic	Description
1	Motivation for the statistical viewpoint
2	Overview of continuum thermo-mechanics
3	Introduction to Hamiltonian mechanics
4	Statistics in statistical mechanics, Phase functions and time averages
5	Phase space dynamics of isolated systems, weakly interacting systems
6	Canonical distributions
7	Concepts of temperature, local equilibrium processes, phase functions for generalized forces
8	First and second laws of thermodynamics
9	Partition function relations, continuum formulations of nonuniform processes
10	Equipartition and alternative definitions of entropy, applications to gases
11	Crystal elasticity, Bravais lattices, harmonic and quasi-harmonic approximations to crystals
12	Constitutive laws for crystalline solids
13	Elasticity of single polymer chains
14	Rubber elasticity of networks
15	Special topics, e.g. monte carlo methods et cetera