Statistical Mechanics I - PHYS 6410

Instructor: Jeong-Young Ji (**email:** j.ji@usu.edu **office:** SER230 **phone:** 797-8118)
Class: 9:00 - 10:15 TR, SER 122
Semester: Fall 2018
Office Hours: TR 10:15-11:15 or by appointment

Course Objectives
Develop a fundamental understanding of the connection between the macroscopic and microscopic worlds.
Explore many body systems both in classical and in quantum mechanics.

Syllabus
Thermodynamics
1. Basic definitions of thermodynamics, equilibrium, state variables
2. The laws of thermodynamics
3. Phase transitions and chemical reactions
4. Thermodynamic potentials
Statistical Mechanics
5. Statistics of microscopic states and connection to the entropy
6. Microcanonical, canonical and grand canonical ensembles
7. Applications of Boltzmann statistics
Quantum Statistics
8. Grand canonical description of ideal quantum systems
9. Ideal Bose gas
10. Applications of ideal Bose gas
11. Ideal Fermi gas
12. Applications of ideal Fermi gas
Real Gases and Phase Transitions
13. Real gases and the virial expansion
14. Classification of phase transitions and critical indices
15. Ising and Heisenberg models
16. Boltzmann and Landau kinetic equations

Text
Lecture Notes based on *Thermodynamics and Statistical Mechanics*, W. Greiner, L. Neise, and H. Stöcker, 1997

Additional References
Undergraduate level
1. *An Introduction to Thermodynamics and Statistical Mechanics*, K. Stowe, 2007.
2. *Thermal Physics*, C. Kittel and H. Kroemer, 1980.
Graduate level (with topics of Statistical Mechanics II included)
3. *Equilibrium Statistical Mechanics*, M. Plischke and B. Bergersen, 1994.
4. *Statistical Mechanics*, R. K. Pathria, 1996.
5. *Statistical Mechanics*, D. A. McQuarrie, 2000.

Grading
Homework (6 sets) 60%, Midterm (November 6) 20%, Final (December 13) 20%
100-90% A, 89-80% A–, 79-70% B+, 69-65% B, 64-60% B–,
59-55% C+, 54-50% C, 49-45% C–, 44-40% D+, 39-35% D, 34-30% D–, 29-0% F

Disability Resource Center
HUSU welcomes students with disabilities. If you have, or suspect you may have, a physical, mental health, or learning disability that may require accommodations in this course, please contact the Disability Resource Center (DRC) as early in the semester as possible (University Inn # 101, 435-797-2444, drc@usu.edu). All disability related accommodations must be approved by the DRC. Once approved, the DRC will coordinate with faculty to provide accommodations.

Honor Code
The honor code will be strictly enforced in this course. Any suspected violations of the honor code will be promptly reported to the honor system. For more information please visit:
http://studentconduct.usu.edu/studentcode/article6.