CHM 6461: Introduction to Statistical Thermodynamics, Spring 2017

Instructor: Prof. Russ Bowers
Email: bowers@chem.ufl.edu
Office Hours: Physics Building, Rm. 2360, TR 1-3 pm (other times by appointment)
Meeting Place and Time: Flint Hall Rm 0111, MWF 8th Period (3:00 – 3:50)

Classes begin/end: January 4/April 19

Holidays
Jan.16: MLK day
March 4-11: Spring break

Course Description
This course gives a self-contained exposition of topics that are generally considered fundamental in modern equilibrium statistical thermodynamics. After a brief review of the role of entropy in the macroscopic (thermodynamic) description, the bridge to the microscopic (statistical) point of view is established. Standard subjects, such as the canonical and grand canonical ensembles, partition functions, and quantum statistics are introduced, followed by applications in chemical physics.

Grading scheme

Midterm Exam	25%
Final Exam	25%
Quizzes (2)	30%
Homework	20%

Required Texts

- Michel Le Bellac, Fabrice Mortessagne and G. George Batrouni, Equilibrium and Non-Equilibrium Statistical Thermodynamics, Cambridge University Press, eISBN: 9780511193705 (available for electronic download from UF library).
- Roger Bowley and Mariana Sanchez, Introductory Statistical Mechanics, Second Edition, 2011, Oxford Science Publications, Clarendon Press, Oxford ISBN 978-0-19-850576-1.

Supplemental Texts

- Donald A. McQuarrie, Statistical Mechanics (Hardcover), Publisher: University Science Books; 2nd Ed. (May 2000), ISBN-10: 1891389157, ISBN-13: 978-1891389153.
- Terrell L. Hill, An Introduction to Statistical Thermodynamics (Also available as an e-book), Dover Publications (January 1, 1987) ISBN-10: 0486652424, ISBN-13: 978-0486652429

Recommended Software: Wolfram's Mathematica**.**

Attendance: 100% attendance is expected.

Make-up Exams: Must be arranged in advance of the scheduled date. Allowed only in emergency situations.

UF Grading Policies: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Tentative Schedule

Week	Topic
1-2	Microscopic and macroscopic variables Postulate of maximum entropy Internal constraints and entropy Quasi-static, reversible, and irreversible processes Stability criteria
3	Probability and statistics
4	Concepts in statistical mechanics Microcanonical ensemble Applications
5-6	Time evolution in quantum mechanics Density operator and time evolution Boltzmann distribution Statistical entropy Time evolution of statistical entropy Equilibrium distributions
7-8	Canonical and grand canonical ensembles Partition functions Relationship to thermodynamic potentials
EXAM 1	
9-11	Monatomic ideal gas Quantum phase space Diatomic and polyatomic molecules Vibrations in solids Paramagnetism Ferromagnetism and Ising model Spin waves
12-13	Identical particles, quantum statistics Bose-Einstein and Fermi-Dirac distributions Maxwell-Boltzmann limit Ideal Fermi gas
14-15	Chemical equilibrium Rates of chemical reactions Absolute rate theory
EXAM 2	