**Department of Chemistry Syllabus**

This syllabi is advisory only. For details on a particular instructor's syllabus (including books), consult the instructor's course page. For a list of what courses are being taught each quarter, refer to the Courses page. *Every instructor has prerogative to teach the course as they see fit and ultimately the instructor's syllabus supersedes all others.*

***CHE 211B: Non-Equilibrium Thermodynamics and Redox Biochemistry***

Approved:

Suggested Textbook: (actual textbook varies by instructor; check your instructor)

D. G. Nicholls and S. J. Ferguson, Bioenergetics 3. Associated Press ISBN 0-12-518121. Order online: Amazon or Alibris.Texts on the web: http://www.biophysics.org/education/topics.htm#mechanisms

Energy Transduction in Membranes (Edited by W.A. Cramer)

Suggested Schedule:

I. Statistical Mechanics and Thermodynamics: Fundamentals

Energy and the First Law. Energy units

Microscopic and Macroscopic states. Thermal equilibrium, statistical behavior, ergodicity

Entropy and the Second Law

Maximum Work

Free energy, Gibbs energy, and other potentials

Thermal fluctuations - activation energy and entropy, transition states

Chemical potential

Binding constants

pKa and redox potentials

Solutions, ionic solutions.

Kinetics of Chemical reactions. Unimolecular and Bimolecular rates

Diffusion.

Dielectric constant

Polarization fluctuations

Solvation Energy.

II. Theory of chemical reactions

Rates of chemical reactions. Unimolecular, Bimolecular rates.

Transition State Theory

RRKM, IVR

Electron transfer

Proton transfer

Coupled ET/PT reactions.

III. Redox systems in biology

Cell respiration and oxidative phosphorylation. Chemiosmotic theory.

Photosynthesis

Fuel cells

Fermentation. Wine oxidation

Additional Notes:

Prerequisite: course 211A

Learning Goals:

Statistical mechanics of nonequilibrium systems, including the rigorous kinetic theory of gases, continuum mechanics transport in dense fluids, stochastic processes, brownian motion and linear response theory.