Chemistry

Fall 2014

**CHEM 521**: Advanced Organic Chemistry I  
Ahmed  
TuThF 1:00-1:50

Content: This course will cover the principles of physical organic chemistry starting with bonding theory, structure, thermochemistry and kinetics. These basic principles will be integrated into a mechanistic description of organic reactions. Techniques for describing, understanding and analyzing reaction mechanisms will be presented ("arrow-pushing", energy profiles, isotope effects, solvent effects, stereochemical and conformational analysis). Prerequisites are organic chemistry and physical chemistry.

Required Text: Modern Physical Organic Chemistry, Eric V. Anslyn/Dennis A. Dougherty

**CHEM 522**: Advanced Organic Chemistry II  
McDonald  
TuThF 12:00-12:50

Content: This course will give an overview of the main classes of reactions that are used in synthetic organic chemistry. Emphasis will be placed in ensuring that the students gain a strong foundation of the mechanisms of these reactions, as well as their scope and limitations, so that the students can effectively use these reactions in practical synthetic applications. The instructor will also provide a perspective on the historical development of related reactions, and will direct the students towards proposing new reactions or variations of known reactions to address unsolved problems in synthetic organic chemistry.

Prerequisite Chem 221-222 (or equivalent introductory organic course).

No text is required. An advanced draft of the instructor's textbook will be distributed at the beginning of the semester.

Students may wish to purchase one or more of the following texts for background, but these are not required:

- Strategic Applications of Named Reactions in Organic Synthesis (Kurti and Czako), Elsevier, ISBN 0-12-429785-4
- Organic Mechanisms (Reinhard Bruckner), Springer-Verlag, ISBN 978-3-642-03650-7
- March’s Advanced Organic Chemistry (Michael B. Smith and Jerry March), ISBN 978-0-471-72091-1

**CHEM 531**: Intro Molecular Quantum Mechanics  
Bowman  
TuTh 10:00-11:15

Content: This course will present the foundations of modern quantum chemistry. The Schroedinger equation and applications to a variety of one, two and three dimensional problems will be presented. The necessary background of special functions and basics of quantum mechanics will also be presented.

Texts: Mathematics for Quantum Chemistry by Jay Martin Anderson

**CHEM 533**: Thermodynamics, Kinetics & Modeling  
Kindt  
TuTh 8:30-9:45

Content: The first part of this course will cover the factors that determine the rates of chemical reactions as well as mass and thermal transport rates in gases and in solution, including the Marcus theory for electron transfer reactions and the RRKM theory for unimolecular decomposition. Students will use molecular simulation to determine rate constants for elementary energy transfer processes in a computer lab exercise. The course will conclude with an overview of thermodynamics, with applications to phase transitions.

Text: Chemical Kinetics and Reaction Dynamics by Paul L. Houston.
**CHEM 551**: Adv Inorganic Chemistry  
Scarborough  
TT  
10:00-11:15

Content: Advanced inorganic chemistry will cover basic coordination chemistry and Group Theory and its application to inorganic chemistry. We will survey the chemistry of inorganic compounds from the standpoint of chemical bonding principles. You will learn to use molecular orbital theory to describe the structure and reactivity of inorganic and organometallic complexes.

Texts (recommended):
- Chemical Structure and Bonding by Dekock and Gray
- Chemical Applications of Group Theory (3rd Edition) by Cotton
- Inorganic Chemistry (4th Edition) by Miessler and Tarr
- Orbital Interactions in Chemistry by Albright, Burdett and Whangbo (2nd Edition)

**CHEM 571**: BioMolecular Chemistry  
Weinert  
MWF  
10:00-10:50

The course will develop a detailed molecular view of the building blocks of life which include nucleic acids, proteins, and lipids. The course will start with a detailed description of nucleotide conformations, biosynthesis, synthetic modification, and a discussion of functional nucleic acids. We will then focus our attention to protein structure, biosynthesis, synthetic modification, the incorporation of unnatural amino acids, and enzyme kinetics.

Texts: N/A

**CHEM 573**: Biotechnology in Chemistry  
Lutz  
MWF  
8:00-8:50

Over the last decade, scientific and technological advances have revolutionized the biosciences. Recombinant DNA technology and next-generation sequencing, robotics and computational modeling, as well as gene/genome synthesis and directed evolution have become the foundation of synthetic biology. Focusing on the recent research literature, basic concepts and experimental protocols will be discussed that range from the construction of genetic circuits to de novo protein design and metabolic engineering, as well as the creation of synthetic genomes.

Texts: N/A

**CHEM 791R**: BioMolecular Seminar

**CHEM 792R**: Inorganic Seminar

**CHEM 793R**: Organic Seminar

**CHEM 794R**: Physical Seminar