CHEM 521 (OPUS 1493)
Advanced Organic Chemistry I
Instructor: Frank McDonald
TTh 1 – 2:15 pm
Emerson 363
3 credits

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 (energy profiles, isotope effects, solvent effects, stereochemical and conformational analysis, catalysis, and electronic structure). Prerequisites are organic chemistry and physical chemistry.

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

CHEM 522 (OPUS 1494)
Advanced Organic Chemistry II (Reactions)
Instructor: Huw Davies
MW 1 – 2:15 pm
MSC_W 307C
3 credits

This course will provide an overview of the main classes of reactions that are used in synthetic organic chemistry. Learning objectives will focus on the mechanistic basis of chemoselectivity between functional groups, regioselectivity among functional groups, and stereoselectivity including enantioselective transformations. This course will prepare students for Chem 523 (Advanced Organic Chemistry III, synthesis) in spring semester. Prerequisite Chem 221-222 (or equivalent introductory organic courses).

Required Text: “Finding the Right Partner: A Survey of Selective Organic Transformations” authored by the instructor, will be distributed gratis to students at the beginning of the semester.

CHEM 531 (OPUS 1495)
Introduction to Molecular Quantum Mechanics
Instructor: Joel Bowman
TTh 11:30 am – 12:45 pm
Emerson 363
3 credits

This course will present the foundations of modern quantum chemistry. The Schrödinger 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.

Required Text: Mathematics for Quantum Chemistry, Jay Martin Anderson
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.

Recommended text: Chemical Kinetics and Reaction Dynamics by Paul L. Houston.

This 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.

Enzyme catalysts will be described using chemical principles. Topics will be organized from the perspective of mechanism and cofactor rather than metabolism or control. Examples from major classes of enzymes will be presented and their mechanisms discussed. Experimental approaches used to investigate catalytic mechanism will also be emphasized.

Recommended text: Introduction to Enzyme and Coenzyme Chemistry, T.D. Bugg

Additional Course Options:

599R Thesis Research (pre-candidacy) (OPUS 1760).
799R Advanced Research (post-candidacy) (OPUS 1764).

Reminders About Courses:

- You must enroll in at least 9 hours to be considered a full-time student.
• All students should meet with their advisor to decide on necessary coursework and register themselves online via OPUS.
• You must be enrolled full time in the semester in which you plan to graduate.
• You will be automatically enrolled in TATT 600, TATT 605, CHEM 504, CHEM 597R, CHEM 606, CHEM 791, CHEM 798 and JPE 600 whenever these courses are required.
• Students who wish to register for courses outside of the Department of Chemistry must complete the External Coursework Petition. This form requires signatures from the advisor, the Instructor of Record for the requested course, and the Director of Graduate Studies.

For any questions, contact the Graduate Coordinator Ana Maria Velez in Atwood 380K.