CHEM 315 (4 credits): Advanced Reactions

Description: An understanding of chemical reactivity, developed in Reactivity 1 and 2, is extended to non-polar systems through the study of redox, radical, photochemical and pericyclic reactions. Molecular orbital theory is exploited to explain a number of reactions. With a firm understanding of an array of reactions in hand, a number of applications, including biochemical pathways such as oxidative phosphorylation and photosynthesis, are examined in detail. The roles of enzyme catalysis, enzyme cofactors and regulatory pathways are also explored. Prerequisite: CHEM 251

Goals and Objectives for CHEM 255:

I. Students will become familiar with oxidation – reduction reactions in inorganic, organic and biochemistry.

- Students will be able to apply standard reduction potentials in order to assess whether reactions are spontaneous.
- Students will be able to deduce what factors influence the thermodynamics of a redox reaction.
- Students will be able to balance redox reactions.
- Students will demonstrate general familiarity with mechanisms of electron transfer.
- Students will demonstrate general familiarity with the role of metals in biochemical redox chemistry.
- Students will be able to apply concepts of reduction - oxidation reactions to new applications.

II. Students will become familiar with radical reactions in inorganic, organic and biochemistry.

- Students will be able to describe some methods for the experimental detection of radicals.
- Students will be able to present mechanisms of radical reactions.
- Students will describe electron transport in oxidative phosphorylation.
- Students will be able to apply concepts of radical reactions to new applications.

III. Students will become familiar with photochemical reactions in organic, inorganic and biochemistry.

- Students will demonstrate basic understanding of how photons interact with matter.
- Students will be able to apply knowledge of photochemistry to real world situations such as atmospheric chemistry.
- Students will be able to provide mechanisms for photochemical reactions in inorganic chemistry.
- Students will be able to describe the role of photochemistry in photosynthesis.
- Students will be able to apply concepts of photochemical reactions to new applications.

IV. Students will become familiar with pericyclic reactions in inorganic, organic and biochemistry.

- Students will be able to draw mechanisms for pericyclic reactions.
- Students will be able to predict regiochemical and steroechemical outcomes of pericyclic reactions.
- Students will be able to show the role of pericyclic reactions in organic oxidations.
- Students will be able to show the role of pericyclic reactions in olefin metathesis.
- Students will be able to show the role of pericyclic reactions in biochemical processes, such as decarboxylations.
- Students will be able to apply concepts of pericyclic reactions to new applications.

V. Students will be exposed to reading literature in organic, inorganic and biochemistry.

- Students will present a short research topic from biochemistry or bioinorganic chemistry.
- Students will be able to make connections between modeling studies and biochemical applications.