

## Upper-Division Course Descriptions

CHM 101, 102 Organic Chemistry I, II (4,4) Prerequisite: CHM 006. Three lectures and one four-hour laboratory per week. Preparation and properties of aliphatic and aromatic compounds, reaction mechanisms, organic synthesis, and qualitative organic analysis in theory and laboratory.

CHM 104 Advanced Inorganic Chemistry (4) Prerequisite: CHM 101. Recommended: CHM 102 and CHM 130/131 or CHM 135. The structure, spectroscopy, and reactivity of main group and transition metal compounds will be presented and systematized in terms of current bonding models, particularly molecular orbital and group theory. The results of these studies will then be applied to problems in bioinorganic, materials, environmental, and organometallic chemistry. Three lectures per week.

CHM 113 Biochemistry (4) Prerequisites: BIO 005 and CHM 101, 102. Introduction to metabolism through a consideration of protein structure-function relationships, enzyme action and regulation, and catabolic and anabolic pathways, emphasizing the metabolism of carbohydrates. Laboratory work emphasizes enzyme isolation and characterization.

CHM 115 Advanced Biochemistry (4) Prerequisite: CHM 113. Examination of biochemical processes with a focus on the metabolism of lipids, amino acids, and nucleotides, and the biochemistry of nucleic acids. Central pathways are considered in detail, including regulatory mechanisms and hormonal signaling. Other selected processes and the integration of mammalian metabolism is explored.

CHM 121 Introductory Analytical Chemistry (4) Prerequisites: CHM 006. Suggested pre- or co-requisite: CHM 101. Three lectures and one four-hour laboratory per week. Provides a theoretical and practical introduction to the analytical process with an emphasis on problem definition, method selection and validation, sampling and sample preparation, analysis, the communication of warranted results, and quality assurance. Course topics include statistics, spectroscopic methods, gas and liquid chromatography, gravimetric analysis, titrimetry, and electromechanical methods. The laboratory portion of the course emphasizes the development of scientific writing proficiency.

CHM 122 Advanced Methods in Chemistry (3) Prerequisites: CHM 101 and CHM 121 or consent of instructor. Two lectures and one four-hour laboratory per week. An advanced integrated course that develops students' proficiency with the use of advanced synthetic and instrumental methods and their application to small molecule, metallurgical, polymeric, nanoscale, food, and environmental systems. Laboratory work focuses on the selection, design and implementation of syntheses and instrumental and wet chemical analysis methods with the aim of developing problem solving, troubleshooting, scientific information literacy, and professional communication skills.

CHM 125 Analog and Digital Instrumental Analysis (4) A laboratory course in analog and digital electronics: assembly language and microprocessors, computer interfacing, data acquisition by analog to digital conversion, and stepping motors. Two lectures and two three-hour laboratories per week.

CHM 130 Physical Chemistry I (3) Prerequisites: MA 010. Corequisite: CHM 132. Postulates in quantum mechanics and application of the Schrodinger's equation to translation, rotation and vibration. Angular momentum, approximation methods, group theory, atomic and molecular structure, spectroscopy, and electric and magnetic properties, chemical kinetics.

CHM 131 Physical Chemistry II/PHY 160 (3) Prerequisites: MA 010 and CHM 130 or PHY 025. Corequisite: CHM 133. Classical equilibrium thermodynamics: applications of the first, second, and third laws to condensed and gas phases. Principles and applications of statistical thermodynamics.

CHM 132, 133 Physical Chemistry Laboratory I, II (1,1) Corequisites: CHM 130 or 131 or 135. One three-hour laboratory per week. Emphasizes thermodynamics, kinetics, electrochemistry, spectroscopy, quantum chemistry, and computer applications. Oral and written presentations of laboratory results are required.

CHM 135 Introductory Physical Chemistry (3) Prerequisite: MA 010. Corequisite: CHM 132 or 133. Applications of physical chemistry to the life sciences. Thermodynamics, energy and the first law, entropy and the second law, free energy and bioenergetics, solar energy. Chemical and biochemical kinetics, biochemical spectroscopy, transport properties, macromolecules.

CHM 150 Special Topics (1/2-4) Prerequisites: CHM 102 (and others possible, depending on topic). Topics include advanced biochemistry, biophysical chemistry, materials chemistry, bioinorganic chemistry, advanced spectroscopy, organometallic chemistry of the transition elements, and electroanalytical chemistry.

CHM 160 Advanced Organic Chemistry (4) Prerequisites: CHM 102 and CHM 131 or CHM 135. Advanced topics in kinetics and mechanisms of organic reactions, stereochemistry, molecular orbital theory, photochemistry, organometallic chemistry, polymers, and natural products. Three lectures and one four-hour laboratory per week.

CHM 190 Chemistry Internship (1) Supervised experiences in the chemistry department or in community and industrial facilities such as clinical or research laboratories. Generally, one unit of credit per semester.

CHM 195 Seminar (1) Prerequisite: Chemistry major and junior standing. Examination of the relationship between chemistry and Christianity with special emphasis given to the role of matter and matter theory in Christian thought, practice, and aspiration; chemical creativity as an expression of the Imago Dei; and the development of philosophies of ministry that support Christian chemists' responsible lifelong engagement with the church and their profession. Weekly reading assignments will address the historical interplay between natural philosophy and religion, the doctrines of creation and the imago dei, the nature of scientific knowledge, environmental stewardship, scientific responsibility, and the scientific vocation.

CHM 198 Chemical Research (2-4) Prerequisites: CHM 102, 125 or 131. Students work closely with a faculty person on original research projects. The results may be reported in research conferences and journal form for publication.

CHM 199 Major Honors (4-6) In consultation with their faculty mentor the Major Honors candidate will develop and execute an advanced level independent research project, produce a fully documented research paper, and pass an oral examination on the research before a committee.