**Course Descriptions**

**Chemistry (CHEM)**

**CHEM 1000 (3) and 1001 (1) Basic Chemistry and Laboratory**. A study of the fundamentals of chemistry. Topics include the metric system, atomic theory, inorganic nomenclature, chemical stoichiometry, properties of gases, liquids and solutions, and acid/base chemistry. Laboratory component emphasizes basic qualitative and quantitative measurements and data interpretation. Three lectures and one three-hour laboratory per week. Offered in fall and spring.

**CHEM 1030 (3) and 1031 (1) General Chemistry for Non-Science Majors I and Laboratory**. A course for non-science majors that focuses on the application of chemistry to society. Topics such as air and water pollution, ozone depletion, global warming, energy, acid rain, and other current environmental issues will be surveyed and implications for personal and societal decisions explored. Laboratory component focuses on the principles learned in lecture. Three lectures and one three-hour laboratory per week. Offered in fall and spring.

**CHEM 1040 (3) and 1041 (1) General Chemistry for Non-Science Majors II and Laboratory**. A continuation of CHEM 1030, 1031. Prerequisites: CHEM 1030, 1031. Three lectures and one three-hour laboratory per week. Offered in fall and spring.

**CHEM 1100 (3) and 1101 (1) Fundamentals of Organic and Biological Chemistry**. A study of the fundamentals of organic chemistry, biochemistry and environmental chemistry. Topics include the nature of organic compounds, and the chemistry and metabolism of biochemical macromolecules and current environmental issues. Laboratory emphasizes principles learned in lecture. Three lectures and one three-hour laboratory per week. Prerequisites: high school chemistry or CHEM 1000/1001 and two years of high school algebra or MATH 1010. Offered in fall and spring.

**CHEM 1110 (3) and 1111 (1) General Chemistry I and Laboratory**. A comprehensive study of chemical principles designed for students pursuing a career in chemistry or other scientific areas. Topics include the metric system and scientific notation, compounds of matter, nomenclature, composition and reaction stoichiometry, types of chemical reactions, thermochemistry, atomic structure, theories of bonding, gases and the kinetic molecular theory, liquids, solids, and thermodynamics. Laboratory complements lecture topics and emphasizes qualitative and quantitative measurements and data interpretation. Prerequisites: high school chemistry or CHEM 1000, 1001, and two years high school algebra or MATH 1110. Three lectures and one three-hour laboratory per week. Offered in fall, spring, and summer.

**CHEM 1112 (3) and 1113 (1) Honors General Chemistry I and Laboratory**. For Chemistry majors and University Honors Program students only. Topics covered are similar to CHEM 1110, 1111, but the depth of understanding expected is greater. Prerequisites: high school chemistry or CHEM 1000, 1001, and two years high school algebra or MATH 1110. Three lectures and one three-hour laboratory per week. Offered only in fall and spring.

**CHEM 1120 (3) and 1121 (1) General Chemistry II and Laboratory.** A continuation of CHEM 1110, 1111. Topics include solutions, acid/base reactions, chemical thermodynamics, chemical kinetics, gaseous equilibria, acid/base and solubility chemical equilibria, electrochemistry, nuclear chemistry, and descriptive organic and inorganic chemistry. Laboratory complements lecture topics and emphasizes qualitative and quantitative measurements, and data interpretation and manipulation. Prerequisites: CHEM 1110, 1111 OR 1112/1113. Three lectures and one three-hour laboratory per week. Offered in fall, spring, and summer.

**CHEM 1122 (3) and 1123 (1) Honors General Chemistry II and Laboratory.** A continuation of CHEM 1112, 1113. Topics covered are similar to CHEM 1120, 1121, but the depth of understanding expected is greater. Prerequisites: CHEM 1112, 1113. Three lectures and one three-hour laboratory per week. Offered only in fall and spring.

**CHEM 2010 (3) and 2011 (1) Organic Chemistry I and Laboratory**. A systematic study of the physical and chemical properties of hydrocarbons and their derivatives. Topics include chemical bonding, structural formula and physical properties, nomenclature, stereochemistry, synthesis and reactions of alkanes, alkenes, alkynes, alkyl halides, and alcohols. Reaction mechanism is emphasized. Laboratory component focuses on reaction set-ups, recrystallization, melting point, distillation, extraction, chromatography, and reactions. Prerequisites: CHEM 1120, 1121, or CHEM 1122, 1123. Three lectures and one three-hour laboratory per week. CHEM 2010, 2011 is required of all Chemistry majors. Offered in fall, spring, and summer.

**CHEM 2012 (3) and 2013 (1) Honors Organic Chemistry I and Laboratory**. For Chemistry majors and University Honors Program students only. Topics are similar to CHEM 2010, 2011, but covered in greater detail. Prerequisites: CHEM 1122, 1123. Three lectures and one three-hour laboratory per week. Offered only in fall and spring.

**CHEM 2020 (3) and 2021 (1) Organic Chemistry II and Laboratory**. A continuation of CHEM 2010, 2011. Emphasis is on the synthesis, reactions, and spectroscopic identification of aromatic compounds, carbonyl compounds (includes aldehydes, ketones, carboxylic acids and their derivatives), and amines. Reaction mechanism is strongly emphasized. Laboratory component exposes students to multi-step synthesis, and spectroscopic and chromatographic characterization of reaction products. Prerequisites: CHEM 2010, 2011. Three lectures and one three-hour laboratory per week. Formerly CHEM 212, 212L. CHEM 2020, 2021 is required of all Chemistry majors. Offered in fall, spring, and summer.

**CHEM 2022 (3) and 2023 (1) Honors Organic Chemistry II and Laboratory**. A continuation of 2012, 2013. Topics covered are similar to CHEM 2020, 2021, but covered in greater detail. Prerequisites: CHEM 2012, 2013. Three lectures and one three-hour laboratory per week. Offered only in fall and spring.

**CHEM 2100 (3) and 2101 (1) Introduction to Analytical Chemistry and Laboratory**. Quantitative methods of chemical analysis. Topics include data manipulation, error analysis and statistical methods; chemical equilibria; acid/base, complexometric and precipitation titrimetry; spectrometric methods; chemical separations and chromatography; analytical glassware, equipment, and instrumentation; and use of computer spreadsheet programs. Laboratory component directly parallels lecture topics. Prerequisites: CHEM 1120, 1121, or CHEM 1122, 1123. Three lectures and one three-hour laboratory per week. Formerly CHEM 210, 210L. Required of all Chemistry majors. Offered in fall and spring.

**CHEM 2500 (3) Introduction to Pharmacology**. An introductory study of mechanisms, dosages, and side effects of pharmacological classes of medication. Three lectures per week. Offered only in fall.

**CHEM 3000 (3) Introduction to Inorganic Chemistry**. An introduction to descriptive inorganic chemistry. Emphasis is on periodicity in structure and reactivity. Topics include bonding, boron chemistry, catalysis, coordination compounds and reaction mechanisms, electronic spectroscopy, and bio-inorganic chemistry. Prerequisites: CHEM 1120, 1121. Offered only in the fall.

**CHEM 3185, 3186, 3187 (3, 3, 3) Cooperative Education I, II, III**. Supervised and approved program of learning experiences undertaken by students in governmental, business, or industrial setting. Formal proposals, project objectives, or learning plans are reviewed and approved by faculty. Student activities and progress are monitored, evaluated, and graded by a full-time faculty member. Prerequisite: permission of Department Chair. Offered in fall, spring, and summer.

**CHEM 3200 (3) and 3201 (1) Physiological Biochemistry and Laboratory**. The fundamentals of human physiological chemistry. Required of majors in foods and nutrition. Prerequisites: CHEM 3600, 3601. Not available for students having credit for CHEM 4700. Three lectures and one three-hour laboratory per week. Offered only in spring.

**CHEM 3210 (3) and 3211 (1) Physical Chemistry I and Laboratory**. Topics covered include the laws of thermodynamics and their application to physical processes and chemical systems, ideal and real gases, single and multi-component phase equilibrium, solutions of non-electrolytes and electrolytes, and electrochemistry. Laboratory component emphasizes the material covered in lecture. Prerequisites: MATH 1910 CHEM 2100, 2101, and either CHEM 2020, 2021 or CHEM 2022, 2023. Three lectures and one three-hour laboratory per week. Offered only in fall.

**CHEM 3220 (3) and 3221 (1) Physical Chemistry II and Laboratory**. A continuation of CHEM 3210, 3211. Topics include kinetic molecular theory, transport processes, reaction kinetics, quantum mechanics, atomic structure, molecular electronic structure, spectroscopy, and photochemistry. Prerequisites: CHEM 3210, 3211. Three lectures and one three-hour laboratory per week. Offered only in spring.

**CHEM 3410 (3) and 3411 (1) General Biochemistry I and Laboratory**. A study of the chemical and physical properties and biological functions of proteins, carbohydrates, lipids, and nucleic acids. Topics include cell membranes, enzyme kinetics and mechanisms, replication, transcription, and translation. Prerequisites: CHEM 2010, 2011. Laboratory component emphasizes ionization of acids and bases, pH and buffers, important biochemical techniques, and the chemistry of the major classes of biological compounds. Three lectures and one three-hour laboratory per week. Offered in fall, spring, and summer.

**CHEM 3420 (3) and 3421 (1) General Biochemistry II and Laboratory.** A continuation of CHEM 3410, 3411. Study of the major catabolic and anabolic pathways, including their chemical reactions, energetics, and regulation. Additional topics include hormones, vitamins, and biochemical function of various organs. Prerequisites: CHEM 3410, 3411. Laboratory emphasizes biochemical and molecular techniques associated with the study of metabolism. Three lectures and one three-hour laboratory per week. Offered in fall, spring, and summer.

**CHEM 3500 (3) Atmospheric Chemistry**. A study of the chemical processes determining the composition of the Earth’s atmosphere including photochemistry, kinetics, thermodynamics, and biogeochemical cycling. This knowledge is applied to the study of aerosols and their impacts on climate and visibility, stratospheric ozone and ozone depletion, oxidation chemistry, ozone air pollution and acid rain, and Arctic and Atmospheric chemistry. Prerequisites: CHEM 2020, 3210. Recommended: CHEM 2100. Offered on demand.

**CHEM 3600 (3) and 3601 (1) Organic Chemistry and Organic Survey Laboratory**. Study of important classes of organic compounds. Emphasis is placed upon the study of hydrocarbons and their principal derivatives: carbohydrates, proteins, fats, oils, vitamins, and dyes. Designed for majors in Agriculture, Home Economics, and Allied Health. Prerequisites: CHEM 1120, 1121. Not available for students having credit for CHEM 2010, 2020. Three lectures and one three-hour laboratory per week. Offered only in fall.

CHE**M 3710 (3) Methods of Teaching High School Chemistry.** A course in the methods of teaching chemistry in the secondary school. Clinical and field-based experiences which call for active participation by students are part of the course requirements. Required of all Chemistry majors in the Teacher Education Program. Prerequisite: official admission to the Teacher Education Program. Offered on demand.

**CHEM 4005 (3) Special Topics in Analytical Chemistry**. Selective topics in Analytical Chemistry which are current and relevant to the discipline. Prerequisite: permission of the instructor. Three lectures per week. Offered on demand.

**CHEM 4006 (3) Special Topics in Biochemistry**. Selective topics in Biochemistry which are current and relevant to the discipline. Prerequisite: permission of the instructor. Three lectures per week. Offered on demand.

**CHEM 4007 (3) Special Topics in Inorganic Chemistry**. Selective topics in Inorganic Chemistry which are current and relevant to the discipline. Prerequisite: Permission of the instructor. Three lectures per week. Offered on demand.

**CHEM 4008 (3). Special Topics in Organic Chemistry**. Selective topics in Organic Chemistry which are current and relevant to the discipline. Prerequisite: permission of the instructor. Three lectures per week. Offered on demand.

**CHEM 4009 (3). Special Topics in Physical Chemistry**. Selective topics in Physical Chemistry which are current and relevant to the discipline. Prerequisite: permission of the instructor. Three lectures per week. Offered on demand.

**CHEM 4100 (2) Scientific Communications**. A focus on writing, oral, and library skills involving scientific information. Writing skills include the preparation of laboratory notebooks, term papers, and research papers. Oral skills concentrate on presentations of scientific results. Library skills include on-line and library literature search for chemical information. Prerequisites: CHEM 2100, 2101, or 2020, 2021. Two one-hour lectures per week. Offered only in spring.

**CHEM 4200 (3) and 4201 (1) Inorganic Chemistry I and Laboratory**. Topics include atomic and molecular structure, quantum mechanics, atomic and group theory, solid state chemistry, acid/base and oxidation/reduction chemistry, and the chemistry of metal complexes. Laboratory provides experience in the synthesis and characterization of inorganic compounds. Prerequisites: CHEM 2020, 2021. Three lectures and one three-hour laboratory per week. Offered only in fall.

**CHEM 4210 (3) Inorganic Chemistry II**. A continuation of CHEM 4200. Course provides a systematic survey of the descriptive chemistry of the elements, building on the theories presented in CHEM 4200. Prerequisites: CHEM 4200, 4201. Offered only in spring.

**CHEM 4320 (3) and 4321 (1) Instrumental Analysis and Laboratory**. Principles and applications of analytical instrumentation, including electrometric, spectrometric, and chromatographic principles. Prerequisites: CHEM 2100, 2101, 3220, 3221. Three lectures and one three-hour laboratory per week. Offered only in spring.

**CHEM 4400 (3) Organic Reaction Mechanisms**. A selective treatment of theoretical and mechanistic aspects of organic chemistry. Course includes an introduction to molecular orbital theory and its application to bonding. Aromatic, pericyclic elimination, and addition reactions are thoroughly treated. Emphasis is on reaction mechanism. Prerequisites: CHEM 2020, 2021, 3220, 3221. Three lectures per week. Offered only in fall.

**CHEM 4420 (3) Medicinal Chemistry**. Medicinal chemistry is a chemistry-based discipline that uses the fundamental concepts of organic chemistry to solve health-related problems. In addition, it involves aspects of biological, medical, and pharmaceutical sciences. It is concerned with the invention, discovery, design, identification and preparation of biologically active compounds, the study of their metabolism, the interpretation of their mode of action, and the development of structure-activity relationship (SAR). Drug development, production, and approval by the Food and Drug Administration are also covered. Pre-requisites: CHEM 2010 and 2020. Offered in Spring.

**CHEM 4500 CANCER BIOCHEMISTRY AND BIOLOGY**. **(3)** An in-depth study of the biochemical and biological basis of cancer.  Topics include biochemistry/biology of: cellular oncogenes; growth factor receptors; tumor suppressors; angiogenesis; invasion and metastasis; and cancer treatment.   Prerequisites: CHEM 3410 or Permission of the instructor. Three hours of lecture per week.  Offered only in Spring

**CHEM 4505, 4506 (2, 2) Senior Project I, II**. A special laboratory investigation carried out under the direction of the instructor. Emphasis is on scientific research and report writing. Must be taken in sequence. Students are expected to spend at least ten hours per week on their research project(s). Prerequisites: CHEM 3220, 3221 or 3320, 3321. Corequisites: CHEM 4910, 4920. CHEM 4505 offered only in fall, 4506 only in spring.

**CHEM 4600 (3) Spectroscopic Methods in Chemistry.** Various spectroscopic methods in chemistry, concentrating on the practical aspect of using spectroscopic techniques to solve structural problems. Techniques include ultraviolet spectroscopy, infrared spectroscopy, nuclear magnetic resonance (NMR) spectroscopy, including Two Dimensional (2-D) NMR in solving problems, and mass spectroscopy (MS). Prerequisites: CHEM 2020, 2021, 3220, 3221. Three lectures per week. Offered only in fall.

**CHEM 4610, 4620 (3, 3) and 4621 (1) Introduction to Polymer Chemistry I, II and Laboratory**. Organic chemical reactions leading to high polymers, physical properties and physical behavior of polymers, polymer processing, and end uses. Prerequisites: CHEM 2020, 2021, or permission of instructor. Three lectures and one three-hour laboratory per week. CHEM 4610 offered only in fall, 4620 and 4621 only in spring.

**CHEM 4700 (3) and 4701 (1) Biochemical Analysis and Laboratory**. Designed to familiarize the student with the principles and practices involved in the analysis of biological and biochemical materials. Topics include separation systems, molecular spectroscopy, radioactivity, ionic strength, and analysis of macromolecules. Laboratory component emphasizes the topics covered in the lectures. Prerequisites: CHEM 2100, 2101, 3220, 3221, 3420, 3421. Three lectures and one three-hour laboratory per week. Offered only in fall.

**CHEM 4720 (9) Student Teaching in Chemistry**. A semester-long experience of supervised practice teaching appropriately divided between middle and secondary schools. Required of all students seeking certification in teaching Chemistry. Prerequisite: successful completion of all certification courses except EDCI 4705, which is taken concurrently. Offered on demand.

**CHEM 4800 ADVANCED PHARMACOLOGY** (3). An in-depth discussion of the principles of pharmacology and how it applies to the evaluation and development of drugs. Topics covered include pharmacokinetics, absorption, metabolism, distribution, transport mechanisms and clinical aspects. Prerequisite: CHEM 3410. Offered only in the Fall

**CHEM 4830 (3) Advanced Physical Chemistry**. A systematic survey of classical transport processes, kinetic molecular theory, statistical mechanics, and absolute reaction rate theory. Prerequisites: CHEM 3220, 3221. Offered only in spring.

**CHEM 4910, 4920 (1, 1) Seminar**. Required of all senior Chemistry majors. Must be taken in sequence. Prerequisites: CHEM 3220, 3221. CHEM 4910 offered only in fall, 4920 only in spring.