

CHEMISTRY (CHEM)

CHEM-112C Fundamentals of General, Organic, and Biochemistry I 3 Credits

An introduction to the study of matter and properties. The course surveys in one semester chemical topics such as: atomic theory, periodic trends, measurements and stoichiometry, chemical reactions, reduction and oxidation chemistry, chemical equilibrium, nuclear chemistry acids and bases. This course is designed for students who need a refresher in general chemistry. It also serves as an excellent introductory course for students in the health sciences or as a general science for non-majors. Course fulfills Core education laboratory science requirement. Lecture three hours.

Co-Requisite: Concurrent: CHEM-112CL

Terms Typically Offered: On Demand.

CHEM-112CL Fundamentals of General, Organic, and Biochemistry I Lab 1 Credit

A complementary laboratory course to CHEM-112C emphasizing the study of matter and properties. This hands-on course teaches basic techniques used in the chemistry lab. Sample experiments include: separation of compounds, chemical precipitation reactions, oxidation-reduction reactions, household chemical qualitative analysis. Laboratory three hours. Lab fee.

Co-Requisite: Concurrent: CHEM-112C

Terms Typically Offered: On Demand.

CHEM-113 Fundamentals of General, Organic, and Biochemistry I 3 Credits

A continuation of the study of matter and its properties. This course explores the following areas of chemistry: Organic Chemistry and Biochemistry. Topics such as: organic functional groups, basic organic reactions, biomolecular structure, metabolism, protein synthesis, and instrumentation will be covered. This course is designed for students in the health sciences, liberal studies, or as a general science for non-majors. Lecture three hours.

Prerequisite: CHEM-112C or permission of instructor.

Terms Typically Offered: On Demand.

CHEM-113L Fundamentals of General, Organic, and Biochemistry II Lab 1 Credit

A complementary laboratory course for CHEM 113. This course implements the following experiments: organic synthesis of aspirin or other analgesics, synthesis of esters, separation of compounds using chromatographic techniques, synthesis of organic dyes, combustion of carbohydrates, analysis of proteins and DNA. This course is designed for students in the health sciences, liberal studies, or as a general science for non-majors. Laboratory three hours. Lab fee.

Prerequisite: CHEM-112CL or permission of instructor.

Co-Requisite: CHEM-113

Terms Typically Offered: On Demand.

CHEM-120 General Chemistry I 3 Credits

Fundamental concepts including chemical reactions, stoichiometry, atomic structure, chemical bonding, changes in state, and the periodic table. This course is intended for those students that intend to pursue graduate education in a science or health science field. A minimum of high school Algebra II and one high school chemistry course is recommended. Three hours lecture per week.

Co-Requisite: CHEM-120L

Pre- or Co-Requisite: CHEM-112C, CHEM-210C or passing score on the Chemistry Placement Exam.

Terms Typically Offered: Fall and Spring.

CHEM-120L General Chemistry I Lab 1 Credit

Students will learn introductory laboratory techniques such as observation, measurement, separations, and identification of reactions. Experiments will involve concepts including: atomic structure, chemical bonding, changes in state, periodic table, oxidation, kinetics, equilibrium, thermodynamics, and electrochemistry. One 4-hour laboratory session per week. Lab fee.

Prerequisite: CHEM-112CL or CHEM-210CL

Co-Requisite: CHEM-120

Terms Typically Offered: Fall and Spring.

CHEM-121 General Chemistry II 3 Credits

Fundamental concepts including kinetics, equilibrium, thermodynamics, and electrochemistry. Special topics will include nuclear chemistry, transition metal periodicity and coordination compounds. Three hours lecture per week.

Prerequisite: CHEM-120

Co-Requisite: CHEM-121L

Terms Typically Offered: Fall, Spring, and Summer.

CHEM-121L General Chemistry II Lab 1 Credit

Students will continue their introduction to laboratory techniques including gravimetric and volumetric analysis, neutralization, and catalysis. Experiments will involve the concepts including: atomic structure, chemical bonding, changes in state, periodic table, oxidation, kinetics, equilibrium, thermodynamics, and electrochemistry. One 4-hour laboratory session per week. Lab fee.

Prerequisite: CHEM-120L

Co-Requisite: CHEM-121

Terms Typically Offered: Fall, Spring, and Summer.



CHEM-210 Integrated Chemistry 4 Credits

This course is designed to give beginning students who have not had prior exposure to chemistry a basic overview in general, organic, and biochemistry. The following topics will be surveyed: matter and energy, atomic theory, stoichiometry, nomenclature, the periodic table, atomic structure, gas liquid and solid states, solutions, nuclear chemistry, functional groups, alkanes, alkenes, alcohols, ethers, aldehydes, ketones, amines, carboxylic acids, lipids, carbohydrates, amino acids, proteins, nucleic acids, metabolism and respiration, photosynthesis, transcription, translation, kinetics, and DNA replication. Upon completion of this integrated chemistry course, the student will have an understanding of basic principles paramount to the study of chemistry, a proficiency with stoichiometry (as it relates to the nursing discipline), writing and interpreting chemical formulas, DNA replication, transcription and translation. In addition, the student should develop an appreciation for the importance of chemistry in other disciplines. (Meets Chemistry requirement for RN to BSN students; meets Science/Lab requirement for Professional Studies students). (School for Professional Studies Course).
Terms Typically Offered: Fall and Spring.

CHEM-210C Integrated Chemistry 4 Credits

This course is designed to give beginning students who have not had prior exposure to chemistry a basic overview in general, organic, and biochemistry. The following topics will be surveyed: matter and energy, atomic theory, stoichiometry, nomenclature, the periodic table, atomic structure, gas liquid and solid states, solutions, nuclear chemistry, functional groups, alkanes, alkenes, alcohols, ethers, aldehydes, ketones, amines, carboxylic acids, lipids, carbohydrates, amino acids, proteins, nucleic acids, metabolism and respiration, photosynthesis, transcription, translation, kinetics, and DNA replication. Upon completion of this integrated chemistry course, the student will have an understanding of basic principles paramount to the study of chemistry, a proficiency with stoichiometry (as it relates to the nursing discipline), writing and interpreting chemical formulas, DNA replication, transcription and translation. In addition, the student should develop an appreciation for the importance of chemistry in other disciplines. Meets the CORE Science Requirement for the traditional undergraduate student when taken with CHEM-201CL.

Co-Requisite: CHEM-210CL

Terms Typically Offered: Fall and Spring.

CHEM-210CL Integrated Chemistry Laboratory 1 Credit

A complementary laboratory course to CHEM-210C emphasizing the study of matter and properties. This hands-on course teaches basic techniques used in the chemistry lab. Sample experiments include: separation of compounds, chemical precipitation reactions, oxidation-reduction reactions, household chemical qualitative analysis. Further, the organic synthesis of aspirin or other analgesics, synthesis of esters, separation of compounds using chromatographic techniques, synthesis of organic dyes, combustion of carbohydrates, analysis of proteins and DNA are performed. This course is designed for students in the health sciences, liberal studies or as a general science for non-majors. This course fulfills the LAB CORE science requirement. Laboratory three hours. Lab fee.

Co-Requisite: CHEM-210

Terms Typically Offered: Fall and Spring.

CHEM-212 Teaching Chemistry I 2 Credits

This course will cover the design of chemistry laboratory experiments to demonstrate and foster the understanding of important chemical principles. Students will both design experiments and analyze experiments from a standard experimental text to determine which principles the experiment is designed to demonstrate. Particular attention will be paid to issues of safety both in the execution of an experiment and in the determination of its suitability for student involvement. In addition to three hours of lab per week, three mandatory visitations to a 6th-12th grade chemistry class per semester (at a public school) will be required. The students will provide oral and written reports on their experiences in the field visitations. Two semester sequence. Lab fee.

Prerequisite: CHEM-121 and CHEM-121L

Co-Requisite: EDUC-315

Terms Typically Offered: On Demand.

CHEM-214 Teaching Chemistry II 2 Credits

This course will cover the design of chemistry laboratory experiments to demonstrate and foster the understanding of important chemical principles. Students will both design experiments and analyze experiments from a standard experimental text to determine which principles the experiment is designed to demonstrate. Particular attention will be paid to issues of safety both in the execution of an experiment and in the determination of its suitability for student involvement. In addition to three hours of lab per week, three mandatory visitations to a 6th-12th grade chemistry class per semester (at a public school) will be required. The students will provide oral and written reports on their experiences in the field visitations. Two semester sequence. Lab fee.

Prerequisite: CHEM-121 and CHEM-121L

Co-Requisite: EDUC-315

Terms Typically Offered: On Demand.

CHEM-252 Analytical Chemistry 3 Credits

The theory of and techniques for calculations pertaining to classical gravimetric and volumetric methods, theory and techniques of separation, and an introduction to instrumental methods. Three hours lecture per week. Offered in alternate years.

Prerequisite: CHEM-120

Co-Requisite: CHEM-252L

Terms Typically Offered: Fall, even years.

CHEM-252L Analytical Chem Techniques 1 Credit

Laboratory experiments in classical gravimetric and volumetric methods, techniques of separation, and an introduction to instrumental methods. One four-hour laboratory session per week. Lab fee. Offered in alternate years.

Prerequisite: CHEM-120L

Co-Requisite: CHEM-252

Terms Typically Offered: Fall, even years.



CHEM-304 Organic Chemistry I 3 Credits

This course is designed to introduce students to organic chemistry. The following topics will be covered: bonding and atomic theory, nomenclature, stereochemistry, functional groups, substitution reactions, elimination reactions, and both electrophilic addition and aromatic substitution reactions. Students will develop a mastery of organic functional groups and nomenclature, an understanding of basic organic reaction mechanisms, a familiarity with common organic reactions, and an appreciation for the importance of organic chemistry in other disciplines. The student will be prepared to continue their education in organic chemistry in the sequential course (CHEM-305). Three hours of lecture per week.

Prerequisite: CHEM-121

Co-Requisite: CHEM-304L

Terms Typically Offered: Fall and Summer.

CHEM-304L Organic Chemistry Techniques I 1 Credit

This is the complementary laboratory course for CHEM-304. This course is designed to develop basic skills and techniques for practical application of the general principles of organic chemistry. The development of a safe approach to lab experimentation will be stressed. Four-hour laboratory session per week. Lab fee.

Prerequisite: CHEM-121L

Co-Requisite: CHEM-304

Terms Typically Offered: Fall and Summer.

CHEM-305 Organic Chemistry II 3 Credits

This course is designed as a continuation of the study of organic chemistry. Students will be introduced to various topics in organic chemistry including: organic oxidations and reductions, carbonyl chemistry, amines, carboxylic acids and their derivatives, organic mechanisms and various biological molecules and building blocks. Three hours of lecture per week.

Prerequisite: CHEM-304 and CHEM-304L

Co-Requisite: CHEM-305L

Terms Typically Offered: Spring and Summer.

CHEM-305L Organic Chemistry Technqs II 1 Credit

This is the complementary laboratory course for CHEM-305. This course is designed to develop basic skills and techniques for practical application of the general principles of organic chemistry including identification of unknowns and multi-step synthesis. The development of a safe approach to lab experimentation will be stressed. Four-hour laboratory session per week. Lab fee.

Prerequisite: CHEM-304 and CHEM-304L

Co-Requisite: CHEM-305

Terms Typically Offered: Spring and Summer.

CHEM-309 Literature and Spectroscopy 2 Credits

This course is designed for transfer students who have previously taken Organic Chemistry 1 and 2 at other institutions. This course introduces basic spectroscopic techniques of organic chemistry and biochemistry: IR, 1D and 2D NMR spectrometry, and MS with some discussion of UV/visible spectrophotometry. Collection and multi-spectral identification of organic compounds is emphasized. Additionally this course includes a survey of chemical literature and methods of its use with emphasis on locating specific chemical information in primary and secondary literature. One hour of lecture and two hours of lab per week. Lab Fee.

Prerequisite: CHEM-304 and CHEM-304L

Terms Typically Offered: On Demand.

CHEM-325 History & Philosophy of Science 3 Credits

Study of selected topics in the history and philosophy of science and the application of these principles in analyzing contemporary scientific trends. Especially recommended for liberal studies majors and those planning to teach physical or biological sciences in secondary schools. Three hours of lecture per week.

Prerequisite: BIOL-121 or BIOL-131; CHEM-121; and PSYCI-223C, PSCI-225, orequivalent.

Terms Typically Offered: On Demand.

CHEM-430 Biochemistry 3 Credits

This course covers topics at the interface of chemistry and biology. Topics include: the chemistry, structure, properties, and function of proteins, carbohydrates, nucleic acids and lipids; enzyme catalysis; membranes; transport; bioenergetics and carbohydrate metabolism. Three hours of lecture per week.

Prerequisite: CHEM-305 and CHEM-305L

Co-Requisite: CHEM-430L

Terms Typically Offered: Fall.

CHEM-430L Experimental Tech/Biochemistry 1 Credit

This is the complementary laboratory course for CHEM-430. This course is designed to enhance the basic skills and techniques learned in the previous foundational experimental chemistry courses. This course focuses on modern biochemical techniques including the operation of chromatographic and spectroscopic instruments used in the practical application biological chemistry. The development of a safe approach to lab experimentation will be stressed. Four-hour laboratory session per week. Lab fee. Offered in alternate years.

Prerequisite: CHEM-305 and CHEM-305L

Co-Requisite: CHEM-430

Terms Typically Offered: Fall.

CHEM-435 Advanced Biochemistry 3 Credits

Advanced Biochemistry provides an in depth view of bioenergetics, catabolism, and biosynthesis. Topics include: carbohydrate, lipid, amino acid, DNA, RNA and protein metabolism; photosynthesis, the structure of genetic material; regulation of metabolism and gene expression. Three hours of lecture per week.

Prerequisite: CHEM-430

Terms Typically Offered: Spring, odd years.

CHEM-440 Instrumental Analysis 2 Credits

An introduction to modern instrumental chemical analysis. The course will span theory of operation, instrument design and methodology, and applications of instrumental techniques. Electrochemical methods including potentiometry, voltammetry, and coulometry; spectroscopic methods including infrared, UV-Vis, and NMR; chromatographic methods including gas, liquid and thin layer; and thermal methods of analysis and kinetic methods of analysis will be covered.

Prerequisite: CHEM-252

Terms Typically Offered: Fall, odd years.



CHEM-440L Instrumental Analysis Lab 2 Credits

Introduces students to the major concepts of instrumental analysis and to some of the instrumental techniques most commonly used in analytical and bioanalytical chemistry. It emphasizes the use of modern, commercial instrumentation to perform quantitative and qualitative analyses of the physical properties and chemical composition of samples. Laboratory Course for 8 hours. Lab fee.

Prerequisite: CHEM-252L

Co-Requisite: CHEM-440

Terms Typically Offered: Fall, odd years.

CHEM-450 UG Research Or Internship Program 1-4 Credits

Prerequisite: Open to juniors and seniors. This course may be taken for a maximum of 4 units in one semester. A maximum of 6 combined units credit for CHEM-450 or CHEM-485 apply to graduation. This course is designed with the purpose of providing students the opportunity to conduct research off-campus at universities or STEM companies in the community. This course promotes early entry into the workplace for the student through part-time employment. This course requires actual work experience be sought in a biotech or STEM-focused business firm providing an opportunity to integrate classroom teaching in practical application under the direct supervision of the assigned instructor. Students are responsible for completing a project report and presenting their research results in CHEM-499C.

Prerequisite: CHEM-121

Terms Typically Offered: Fall and Summer.

CHEM-455 Chemistry Teaching Internship 1-3 Credits

Regular hours each week for classes and/or meetings are established at the beginning of the semester. The intern assists an instructor in planning and conducting a course, and/or laboratory sessions. This course may be taken for 1-3 units per semester. May be repeated for a maximum of six units.

Terms Typically Offered: Fall and Spring.

CHEM-456 Physical Chemistry: Thermodynamics 2 Credits

Laws, principles and concepts of chemistry concerning the properties of gases, the laws of thermodynamics, the theory and equations of phase changes in both pure and mixed substances, chemical equilibrium, equilibrium electrochemistry. Two hours lecture per week. Offered in alternate years.

Prerequisite: CHEM-121, MATH-181; MATH-281 preferred.

Terms Typically Offered: Fall, odd years.

CHEM-456L Physical Chemistry Technique Lab 1-2 Credits

When taken for one unit, experiments involving the properties of gases, the laws of thermodynamics, the theory and equations of phase changes in both pure and mixed substances, chemical equilibrium, equilibrium electrochemistry, molecular motion and diffusion, and both classical and molecular chemical kinetics. When taken for two units, additional experiments involving: quantum properties of atoms and molecules; electrical properties of atoms and molecules; rotational, vibrational, and electronic spectroscopy; statistical-mechanical analysis of the thermodynamic and phase change properties of atoms and molecules; and the physical chemistry of macromolecules. Formal journal-style reporting required. Four to eight hours laboratory per week. Lab fee per unit.

Prerequisite: CHEM-252 and CHEM-252L

Terms Typically Offered: Spring, even years.

CHEM-457 Physical Chemistry: Kinetics 2 Credits

Laws, principles and concepts of chemistry concerning molecular motion and diffusion, both classical and molecular chemical kinetics, and introductory statistical mechanics. Two hours lecture per week. Offered in alternate years.

Prerequisite: CHEM-121, Math-181; MATH-281 preferred.

Terms Typically Offered: Spring, even years.

CHEM-458 Physical Chemistry: Quantum Mechanics 2 Credits

Laws, principles, and concepts of chemistry concerning: quantum mechanics; quantum properties of atoms and molecules; symmetry of molecules; rotational, vibrational, electronic, and magnetic (nuclear) spectroscopy and introductory statistical mechanics. Two hours lecture per week. Offered in alternate years.

Prerequisite: CHEM-457, MATH-281

Terms Typically Offered: Spring, even years.

CHEM-460 Physical Chemistry I 3 Credits

Laws, principles and concepts of chemistry concerning the properties of gases, the laws of thermodynamics, the theory and equations of phase changes in both pure and mixed substances, chemical equilibrium, equilibrium electrochemistry, molecular motion and diffusion, both classical and molecular chemical kinetics. Three hours lecture per week. Offered in alternate years.

Prerequisite: CHEM-121, CHEM-252, and MATH-180C

Co-Requisite: CHEM-460L

Terms Typically Offered: Fall, odd years.

CHEM-460L Physical Chemistry Lab 1 Credit

Experiments involving the properties of gases, the laws of thermodynamics, the theory and equations of phase changes in both pure and mixed substances, chemical equilibrium, equilibrium electrochemistry, molecular motion and diffusion, and classical chemical kinetics. Formal journal-style reporting required. Four hours laboratory per week. Lab fee.

Prerequisite: CHEM-121L and CHEM-252L

Co-Requisite: CHEM-460

Terms Typically Offered: Fall, odd years.

CHEM-461 Physical Chemistry II 3 Credits

Laws, principles and concepts of chemistry concerning quantum mechanics; quantum properties of atoms and molecules; symmetry of molecules; rotational, vibrational, electronic, and magnetic (nuclear) spectroscopy; and introductory statistical mechanics. Three hours lecture per week. Offered in alternate years.

Prerequisite: CHEM-252, MATH-181, MATH-281

Terms Typically Offered: Spring, even years.

CHEM-470 Special Topic: 1-4 Credits

Study in a special topic in chemistry. May be repeated for credit. May have a lab fee. Topics may include advanced inorganic chemistry, rates and mechanisms in organic chemistry, synthetic methods in organic chemistry, or other advanced topics.

Terms Typically Offered: On Demand.

CHEM-480 Individual Studies: 1-4 Credits

Terms Typically Offered: On Demand.



CHEM-485 Undergraduate Research 1-4 Credits

Problems in advanced laboratory research with emphasis on research techniques. Research is carried out under the supervision of the instructor with weekly conferences to discuss results and direction. Emphasis will be placed on project management, safety, instrumentation, solution preparation, and research documentation skills. A written proposal and report emphasizing the literature background of the problem and the experimental results are required. The results of the research project will also be presented in an oral format in CHEM-499C. This course is a variable credit course. At least two units are required for all chemistry and biochemistry majors. A minimum of 50 hours of laboratory work is required per unit. May be repeated. Lab fee. Terms Typically Offered: Fall and Summer.

CHEM-488 Chemistry Senior Project 2 Credits

An advanced course providing the opportunity for a student to create a novel and independent intellectual work by comparing, contrasting, and synthesizing recent research and his/her cumulative knowledge and understanding in Chemistry. The precise nature, scope and format of the project must be developed and approved under the guidance of the instructor and in collaboration with the student's academic advisor. Senior projects are typically initiated in the Fall. The project results must also be presented in CHEM-499C. Lab fee.

CHEM-499C Chemistry Capstone Seminar 2 Credits

This course includes a senior thesis covering an approved research topic, analysis and evaluation of current research in chemistry, and the integration of faith and the chemical sciences. An oral presentation of the senior thesis in a classroom setting is required. In-class presentations by faculty and guests are part of the course. Laboratory research in an on-campus research program or an approved off-campus research program may be required for the senior thesis. This course fulfills the Core Curriculum Capstone requirement for Chemistry majors. Terms Typically Offered: Spring.

