CHEM: CHEMISTRY (UNDERGRADUATE)

CHEM 1002 Chemistry in Context (4 Credits)
This study is designed for non-science majors. It will introduce the fundamental principles and concepts of chemistry and apply them to understand a variety of contemporary environmental and socio-technological issues. Core chemistry topics include atomic and molecular structure, stoichiometric calculations, chemical bonding, periodicity of properties of the elements, thermochemistry, properties of gases and solutions, chemical reactions, and an overview of the classes of organic. Principles of chemistry will be applied to the consideration of quality of air and water, global warming, acid rain, energy production and utilization, synthetic materials, recycling, drugs, and nutrition. Highly Recommended (not required): The ability to manipulate simple algebraic expressions Note: No prior knowledge of chemistry is required.
Attributes: Natural Science Gen Ed, *Natural Science Gen Ed, Liberal

CHEM 1205 Chemistry I with Lab (4 Credits)
Chemistry I with Lab is the first course of the two-term sequence in general chemistry for science majors. It teaches students to understand the basic chemical principles behind chemical reactions. The course will start by introducing the definitions and tools used in chemistry, and will then move on to present the models used to describe atoms and molecules and their interactions (chemical bonds). The student will learn to predict, write, and balance chemical reactions, including the exchange of heat (energy). The students will also learn the characteristic behaviors of gases, liquids and solids. Students will gain experience in basic laboratory techniques. This course uses a mandatory hands-on lab kit to provide students an authentic laboratory experience. The kit (in addition to the textbook) will add an additional cost to the Course Materials. See the Learning Contract/Syllabus for specific details.
Attributes: Natural Science Gen Ed, *Natural Science Gen Ed, Liberal

CHEM 1206 Chemistry II with Lab (4 Credits)
Chemistry II with Lab is the second course of the two-term sequence in general chemistry for science majors. The course will examine the characteristics of aqueous solutions, followed by the principles and applications of kinetics and chemical equilibrium. Specific chemical reactions will be explored, including acid-base neutralization, precipitation, and solubility. Attention will then focus on thermodynamics and electrochemistry. After introducing the basics of nuclear chemistry, heavy isotopes, and radiation, the trends of reactivity and characteristics of metals and non-metals will be presented, followed by an overview of the basic chemistry of organic compounds. Students will gain further experience in basic laboratory techniques. This course uses a mandatory hands-on lab kit to provide students an authentic laboratory experience. The kit (in addition to the textbook) will add an additional cost to the Course Materials. See the Learning Contract/Syllabus for specific details. Prerequisites: Chemistry I with Lab (CHEM 1205) or equivalent.
Attributes: Natural Science Gen Ed, *Natural Science Gen Ed, Liberal

CHEM 1210 Chemistry I: Lecture (3 Credits)
Chemistry I is the first course of a two-term sequence in general chemistry for science concentrations. This three-credit course covers the lecture and not the laboratory component of the sequence, which is offered as a separate course. Students will learn the basic chemical principles behind chemical reactions. They will study the models used to describe atoms and molecules and the chemical bonds that form between them. Students will learn to predict, write, and balance chemical reactions. Other topics will include exchange of heat (energy) and characteristic behaviors of gases, liquids and solids. Notes: This lecture course complements the lab component covered in Chemistry I Laboratory, but it is not a co-requisite to the lab.
Attributes: Natural Science Gen Ed, *Natural Science Gen Ed, Liberal

CHEM 1211 Chemistry I: Laboratory (1 Credits)
This is a one-credit laboratory course that supports the Chemistry I course. Students will learn basic knowledge of the general principles of chemistry through laboratory exercises. Students will practice laboratory techniques using chemical laboratory equipment. This course uses a mandatory hands-on lab kit to provide students an authentic laboratory experience. The kit (in addition to the textbook) will add an additional cost to the Course Materials. See the Learning Contract/Syllabus for specific details. Notes: This laboratory course complements the lecture component covered in Chemistry I, but it is not a co-requisite to the lecture.
Attributes: Liberal

CHEM 1212 Chemistry II: Lecture (3 Credits)
Chemistry II is the second course of a two-term sequence in general chemistry for science concentrations. This three-credit course covers the lecture and not the laboratory component of the sequence, which is offered as a separate course. Students will learn the characteristics of aqueous solutions, and the applications of kinetics and chemical equilibrium. They will study specific chemical reactions, such as acid-base neutralization, precipitation, and solubility. Other topics will include thermodynamics, electrochemistry, introduction to nuclear chemistry, characteristics of metals and non-metals, and basic chemistry of organic compounds. Notes: This lecture course complements the lab component covered in Chemistry II Laboratory, but it is not a co-requisite to the lab. Prerequisites: CHEM 1210 or equivalent.
Attributes: Natural Science Gen Ed, *Natural Science Gen Ed, Liberal

CHEM 1213 Chemistry II: Laboratory (1 Credits)
This is a one-credit laboratory course that supports the Chemistry II course. Students will learn basic knowledge of the general principles of chemistry through laboratory exercises. Students will practice laboratory techniques using chemical laboratory equipment. This course uses a mandatory hands-on lab kit to provide students an authentic laboratory experience. The kit (in addition to the textbook) will add an additional cost to the Course Materials. See the Learning Contract/Syllabus for specific details. Notes: This laboratory course complements the lecture component covered in Chemistry II, but it is not a co-requisite to the lecture. Prerequisites: Chemistry I (CHEM 1210) or equivalent.
Attributes: Liberal

CHEM 1994 Special Topics in Chemistry (1-8 Credits)
Attributes: Liberal

CHEM 1995 Special Topics in Chemistry (1-8 Credits)
Attributes: Liberal

CHEM 1996 Special Topics in Chemistry (1-8 Credits)
Attributes: Liberal

CHEM 1997 Special Topics in Chemistry (1-8 Credits)
Attributes: Liberal

CHEM 1998 Individualized Studies in Chemistry (CHEM) (1-8 Credits)
Students have the opportunity to develop individualized studies with their mentor in Chemistry (CHEM). Registration for this class must be approved by the student's mentor.

CHEM 2220 Principles of Organic Chemistry (4 Credits)
This survey of organic chemistry may be of interest to students concentrating in life sciences. It will examine on structure, properties, and reactions of the main classes of organic compounds: alkanes and cycloalkanes; alkenes and alkynes; aromatic compounds (benzene and its derivatives); alcohols, ethers, and thiols; amines; aldehydes and ketones; carboxylic acids, anhydrides, esters, and amines; and stereochemistry of organic molecules. Students will be introduced to functional group chemistry, reaction mechanisms, the relationship between molecular structure and reactivity, and to main spectroscopic techniques used for molecular structure elucidation. Numerous examples will illustrate the biological and medical applications of organic chemistry. Notes: This study might be of interest to students with concentrations in life sciences. Students pursuing concentration in chemistry are to take Organic Chemistry I with Lab (CHEM 3210) or Organic Chemistry I (CHEM 3220), and Organic Chemistry II (CHEM 3221). Prerequisites: Chemistry I with Lab (CHEM 1205) and Chemistry II with Lab (CHEM 1206) or equivalents. This course cannot be used as a prerequisite for CHEM 3221.
Attributes: Liberal

CHEM 2998 Individualized Studies in Chemistry (CHEM) (1-8 Credits)
Students have the opportunity to develop individualized studies with their mentor in Chemistry (CHEM). Registration for this class must be approved by the student's mentor.

CHEM 3200 Inorganic Chemistry (4 Credits)
This one semester survey of modern inorganic chemistry introduces descriptive inorganic chemistry, with emphasis on its physical principles and practical applications. Topics include chemical bonding, molecular orbital theory, symmetry and group theory, main group elements, the crystalline solid state, acid-base and donor-acceptor chemistry of d-block metals, and the structure, bonding, reactivity, electronic spectra, and some reaction mechanisms of their coordination compounds. Notes: This is a stand-alone course. It should not be taken by students planning to take the two-term sequence of inorganic chemistry: Chemistry I with Lab (CHEM 1205) and Chemistry II with Lab (CHEM 1206). Prerequisites: Chemistry I with Lab (CHEM 1205) and Chemistry II with Lab (CHEM 1206) or equivalents.
Attributes: Liberal

CHEM 3210 Organic Chemistry I with Lab (4 Credits)
Organic Chemistry I with Lab is the first course of a two-term sequence in organic chemistry designed for science concentrations. The discipline of organic chemistry involves identifying the molecular structure and properties of substances found in nature, and finding ways of synthesizing these substances. This Organic Chemistry I with Lab course introduces students to many of the basic concepts required for this process. Students will investigate the mechanisms of organic reactions to gain the ability to predict the outcomes of similar reactions. Other topics will include nomenclature, molecular structure, chemical reactivity, isomers, thermodynamics, and kinetics. Students will gain experience in organic chemistry laboratory techniques. This course uses a mandatory hands-on lab kit to provide students an authentic laboratory experience. The kit (in addition to the textbook) will add an additional cost to the Course Materials. See the Learning Contract/Syllabus for specific details. Prerequisites: CHEM 1205 and CHEM 1206, or equivalents.
Attributes: Liberal

CHEM 3220 Organic Chemistry I (4 Credits)
Organic Chemistry I is the first part of a two-term course sequence designed for students majoring in physical and life sciences. It introduces fundamental principles of organic chemistry with an emphasis on functional group chemistry, the relationship between molecular structure and reactivity, and reaction mechanisms. Topics include classes of organic compounds and their functional groups; nomenclature; organic reactions and their mechanisms; isomerism; properties and conformations of alkanes and cycloalkanes; stereochemistry; alkyl halides and nucleophilic substitution and elimination reactions; properties, synthesis and reactions of alkenes and alkynes; and main spectroscopic tools for molecular structure elucidation. Prerequisites: Chemistry I with Lab (CHEM 1205) and Chemistry II with Lab (CHEM 1206) or equivalents.
Attributes: Liberal

CHEM 3221 Organic Chemistry II (4 Credits)
Organic Chemistry II is the second part of a two-term course sequence designed for students majoring in physical and life sciences. It continues to introduce the study of structure, reactions, and synthesis of the major classes of organic compounds. Topics include radical reactions, alcohols and ethers, conjugated unsaturated systems, aromatic compounds, aldehydes and ketones, carboxylic acids and their derivatives, and amines. Prerequisites: Chemistry I with Lab (CHEM 1205) and Chemistry II with Lab (CHEM 1206) or equivalents, and Organic Chemistry I with Lab (CHEM 3210) or Organic Chemistry I (CHEM 3220) or equivalent. Students who completed CHEM 2220 are not eligible to enroll in this class.
Attributes: Liberal

CHEM 3300 Physical Chemistry I (4 Credits)
This course is designed for students majoring in Chemistry and requires strong quantitative skills. The goal of the two-term course sequence in Physical Chemistry is to introduce students to the theoretical models and laws that help explain the physical, thermal, electrical and chemical properties of matter. The main focus of this first part of the sequence will be kinetic molecular theory of gases, gas laws, and the three laws of thermodynamics. Additional topics will be selected among: free energy and chemical potential, chemical equilibrium, electrolyte and nonelectrolyte solutions, electrochemistry, and chemical kinetics. Notes: Basic knowledge of Calculus is strongly preferred. Prerequisites: CHEM 1205, CHEM 1206, and MATH 1040 or MATH 1140, or equivalents.
Attributes: Liberal

CHEM 3302 Physical Chemistry II (4 Credits)
This course is designed for students majoring in Chemistry and requires strong quantitative skills. The goal of the Physical Chemistry course sequence is to introduce students to the theoretical models and laws that help explain the physical, thermal, electrical and chemical properties of matter. The focus of this second part of the sequence will be Quantum Chemistry, the Solid State and Surface Thermodynamics. Specific topics will include: Introduction to Quantum Mechanics, Quantum Mechanics Model Systems, the Hydrogen Atom, Atomic and Molecular Orbital Theories, Symmetry in Quantum Mechanics, Rotational Spectroscopy, Vibrational Spectroscopy, Electronic Spectroscopy, Magnetic Spectroscopy, and Statistical Thermodynamics. Notes: Basic knowledge of Calculus is strongly preferred. Prerequisites: Chemistry I with Lab (CHEM 1205) and Chemistry II with Lab (CHEM 1206), and Algebra (MATH 1040) or Precalculus (MATH 1140), or equivalents, and Physical Chemistry I (CHEM 3200).
Attributes: Liberal

CHEM 3400 Biochemistry (4 Credits)
This study focuses on explaining biology in chemical terms. Its main topics are subdivided into three categories. The first one, structure and function of biomolecules, covers properties of water, acids, bases, and buffers; amino acids and peptide bonds; three-dimensional structure of proteins; enzymes, enzyme kinetics, and mechanisms; coenzymes, and vitamins; carbohydrates; and lipids and biological membranes. The second category, energetics and metabolism, includes glycolysis, Krebs cycle, glycogen mechanism and gluconeogenesis, electron transport and oxidative phosphorylation, lipid metabolism, amino acids and nucleotide metabolism. Finally, the third category, genetic information, focuses on nucleic acids and related biochemical pathways. Notes: This course is designed for science students who would prefer one term of Biochemistry. Prerequisites: Chemistry I with Lab (CHEM 1205) and Chemistry II with Lab (CHEM 1206) and Biology I with Lab (BIOL 1200) and Biology II with Lab (BIOL 1201) or equivalents.
Attributes: Natural Science Gen Ed, Liberal

CHEM 3600 Principles of Instrumental Analysis: Spectroscopy & Separation Techniques (4 Credits)
This course is designed for science majors. A survey of spectroscopic and chromatographic methods, including theoretical background and operating principles of chemical instrumentation, will be provided. Application of these methods of instrumental analysis to solutions of chemical problems, including identification and characterization of chemical compounds, will be emphasized. Topics in molecular spectroscopy include UV-Visible and Infrared spectroscopy, Mass Spectrometry, and Nuclear Magnetic Resonance spectroscopy. Techniques of separation include single- and multi-stage methods, with emphasis on gas and liquid chromatography. Prerequisites: Organic Chemistry II, and Physics II with Lab II or equivalent.
Attributes: Liberal

CHEM 3602 Quantitative Chemical Analysis (4 Credits)
This course is designed for science majors. It focuses on physical understanding of the principles of analytical chemistry and their applications in chemistry and other disciplines, including life and environmental sciences. Selected modern analytical techniques will be surveyed with emphasis on their operating principles and on applications of theoretical principles and analytical instruments to practical problem solving. Topics include: the analytical process, measurements, analytical tools, experimental error, quality assurance and calibration methods, activity, systematic treatment of chemical equilibria, acid-base equilibria and titrations, fundamentals of electrochemistry, types of electrodes, potentiometry, and electroanalytical techniques. Prerequisites: Prerequisites: Chemistry I with Lab (CHEM 1205) and Chemistry II with Lab (CHEM 1206) or equivalents.
Attributes: Liberal

CHEM 3996 Special Topics in CHEM (2-6 Credits)
Attributes: Liberal

CHEM 3998 Individualized Studies in Chemistry (CHEM) (1-8 Credits)
Students have the opportunity to develop individualized studies with their mentor in Chemistry (CHEM). Registration for this class must be approved by the student's mentor.

CHEM 4200 Inorganic Chemistry I (4 Credits)
This is the first part of the two term course sequence in inorganic chemistry, designed for chemistry majors. It introduces descriptive inorganic chemistry, with emphasis on its physical principles and practical applications. Topics include chemical bonding in polyatomic molecules, molecular symmetry and group theory, the crystalline solid state, acid-base reactions in aqueous and non-aqueous media, redox chemistry, chemical characterization techniques, and properties and reactions of the main group elements. Prerequisites: Organic Chemistry II, and Physical Chemistry I.
Attributes: Liberal

CHEM 4201 Inorganic Chemistry II (4 Credits)
This second study in the two-term course sequence of modern inorganic chemistry focuses on the d-block metals. Topics include characteristic physical and chemical properties and reactivity of metals, their coordination chemistry, isomerism, valence bond model and molecular orbital theories, crystal field stabilization, electronic absorption and emission spectra, and magnetic properties. The discussion of general principles is followed by a systematic consideration of the d-block metals, their physical properties, chemistry of their inorganic, coordination, and organometallic compounds, and the importance of these inorganic and organometallic compounds in industry, catalysis, materials, nanotechnology, and biological processes. Prerequisite (must complete before registering): Inorganic Chemistry I (CHEM 4200)
Attributes: Liberal

CHEM 4300 Environmental Chemistry I (4 Credits)
Environmental Chemistry I is the first part of a two-term course sequence designed for advanced level students majoring in natural sciences. The purpose of the Environmental Chemistry studies is for the student to gain knowledge about the chemistry of current environmental problems in order to critically evaluate them and provide possible solutions to these issues. Main topics that will be covered this first part of the sequence include: atmospheric chemistry, air pollution, energy and climate change. The study will also devote time to learn about Green Chemistry, the initiative set forth to encourage chemical companies to develop products and processes that reduce environmental hazards. Notes: Basic knowledge of Calculus is strongly preferred. Prerequisites: Chemistry I with Lab (CHEM 1205) and Chemistry II with Lab (CHEM 1206), and Algebra (MATH 1040) or Precalculus (MATH 1140), or equivalents, and Organic Chemistry I (3220) or equivalent.
Attributes: Liberal

CHEM 4301 Environmental Chemistry II (4 Credits)
Environmental Chemistry II is the second part of a two-term course sequence designed for advanced level students majoring in natural sciences. This second course of the sequence will focus on toxic organic chemicals, water pollution, soil pollution and purification techniques. In addition, students will continue to learn about processes that have been developed to meet Green Chemistry standards. Notes: Basic knowledge of Calculus is strongly preferred. Prerequisites: Chemistry I with Lab (CHEM 1205) and Chemistry II with Lab (CHEM 1206), and Algebra (MATH 1040) or Precalculus (MATH 1140), or equivalents, Organic Chemistry I (3220) or equivalent, and Environmental Chemistry I (CHEM 4300).
Attributes: Liberal

CHEM 4400 Biochemistry I (4 Credits)
This course is the first part of a two term course sequence designed for students majoring in chemistry and life sciences. Its main objectives are to explain biology in chemical terms; introduce the language of biochemistry; examine physical, chemical, and biological context of biochemical reaction mechanisms; establish the relationship between structure and function and between different biochemical processes; and explore the most important biochemical research techniques. The main topics include the structure and function of the four major classes of biomolecules - proteins, carbohydrates, lipids, and nucleic acids, as well as the biological membranes and transport. Prerequisites: Organic Chemistry I and II A background in physical chemistry is helpful, but not required.
Attributes: Liberal

CHEM 4401 Biochemistry II (4 Credits)
This second portion of the two term course sequence in biochemistry, designed for students majoring in chemistry and life sciences, will focus on biosignaling, bioenergetics, organization and regulation of biosynthetic pathways, metabolism, DNA replication and RNA transcription. Topics include the principles of bioenergetics; degradation and biosynthesis of carbohydrates, fatty acids, amino acids, and nucleic acids; signal transduction; oxidative phosphorylation; and integration and regulation of metabolism. Prerequisites: Biochemistry I.
Attributes: Liberal

CHEM 4998 Individualized Studies in Chemistry (CHEM) (1-8 Credits)
Students have the opportunity to develop individualized studies with their mentor in Chemistry (CHEM). Registration for this class must be approved by the student's mentor.