CHEM 0900. CHEMISTRY SEMINAR. (0 Credits)

CHEM 1101. FOOD CHEMISTRY. (3 Credits)
A study of the nature of food and what happens to it when stored, processed, preserved, cooked, eaten and digested. The scientific foundation for our knowledge of food will be discussed. The course is intended for students who have never taken college or high school chemistry. There will be five or six laboratory experiments where the student will analyze foods. (No laboratory fee.)
Attribute: CO09.

CHEM 1104. THE CHEMISTRY OF ART. (3 Credits)
An investigation into the chemical basis of color includes why color arises and how it is measured, as well as an introduction to the chemistry of dyes, pigments and glazes. Techniques in conservation and authentication of art will be discussed. Course requirements include several laboratory experiments. The course is intended for students with little or no background in chemistry. (No laboratory fee.)
Attribute: PSCI.

CHEM 1109. CHEMISTRY OF THE ENVIRONMENT. (3 Credits)
An introduction to the principles of chemistry within the context of environmental and societal issues. These principles are introduced via sequential discussion of theories of matter and its transformation (chemical reactions), chemical sources of energy, and methods of testing and analysis. Specific applications, such as toxicity, pollution, and methods of remediation are discussed in conclusion. No lab fee.
Attribute: ENST.

CHEM 1110. FORENSIC SCIENCE. (3 Credits)
An introductory lecture and laboratory course designed for non-science majors who have not taken chemistry. A study of the methods and techniques in forensic science. Topics include fires, explosions, drugs, forensic toxicology, glass and soil, paints, fibers, hair, blood, body fluids, fingerprints, toolmarks and firearms. Several short lab experiments. The course is intended for students with little or no background in chemistry. (No laboratory fee.)
Attribute: PSCI.

CHEM 1311. GENERAL CHEMISTRY I RECITATION. (0 Credits)
Recitation to accompany General Chemistry I.
Corequisite: CHEM 1321.

CHEM 1312. GENERAL CHEMISTRY II RECITATION. (0 Credits)
Recitation to accompany General Chemistry II.
Corequisite: CHEM 1322.

CHEM 1321. GENERAL CHEMISTRY I. (4 Credits)
(3-hour lecture and 1-hour recitation) A course covering the fundamental laws and theories of chemistry including chemical equations, atomic structure, gas laws and chemical bonding. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Attribute: ENVS.
Corequisite: CHEM 1331.
Mutually Exclusive: NSCI 1321.

CHEM 1322. GENERAL CHEMISTRY II. (4 Credits)
(3-hour lecture and 1-hour recitation) A continuation of CHEM 1321, including kinetics, equilibrium, elementary thermodynamics and electrochemistry. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Attribute: ENVS.
Corequisites: CHEM 1312, CHEM 1332.
Prerequisite: CHEM 1321.
Mutually Exclusive: NSCI 1322.

CHEM 1331. GENERAL CHEMISTRY LAB I. (2 Credits)
(4 hour laboratory) A series of experiments selected to illustrate the topics covered in CHEM 1321. Lab fee.
Attribute: ENVS.
Corequisites: CHEM 1311, CHEM 1321.
Mutually Exclusive: NSCI 1331.

CHEM 1332. GENERAL CHEMISTRY LAB II. (2 Credits)
(4-hour laboratory) A selection of experiments designed to correspond to the material covered in CHEM 1322. An abbreviated qualitative analysis is also included. Lab fee.
Attribute: ENVS.
Prerequisite: CHEM 1331.
Mutually Exclusive: NSCI 1332.

CHEM 1990. INTRODUCTION TO RESEARCH. (0 Credits)
This course serves as an introduction to scientific research. The goals of the course are to introduce students to the process of scientific research by direct involvement. Students will participate in aspects of data collection, analysis, interpretation, and presentation. Open to all majors. Freshman and sophomores only. Registration only with permission of faculty mentor.

CHEM 2511. ORGANIC CHEMISTRY I RECITATION. (0 Credits)
Corequisite: CHEM 2521.

CHEM 2512. ORGANIC CHEMISTRY II RECITATION. (0 Credits)
Corequisite: CHEM 2522.

CHEM 2521. ORGANIC CHEMISTRY I. (4 Credits)
(3-hour lecture, 1 hour recitation) An introduction to bonding, structure and reactivity of organic compounds including aliphatic and aromatic hydrocarbons, alkyl halides and alcohols. Concepts include orbital hybridization, stereochemistry, equilibrium reactions, transition state theory and kinetics. Determination and discussion of reaction mechanisms will be emphasized. Chemical and spectral methods for structure elucidation, including NMR, IR, UV and MS will be discussed. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Attribute: ENVS.
Prerequisites: CHEM 1321 or CHEM 1322 and CHEM 1331 or CHEM 1332.
Mutually Exclusive: NSCI 3121.
CHEM 2522. ORGANIC CHEMISTRY II. (4 Credits)
(3 hour lecture, 1 hour recitation) A continuation of CHEM 2521. Concentrates on the chemistry of aromatic, carbonyl and amino compounds, with particular emphasis on reactive mechanisms and synthesis. Includes descriptive chemistry of biologically important molecules such as carbohydrates, proteins and lipids. Aspects of synthetically important cycloaddition reactions will also be discussed. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Attribute: ENVS.
Prerequisite: CHEM 2521.

CHEM 2531. ORGANIC CHEMISTRY LAB I FOR CHEM MAJORS. (2 Credits)
A laboratory course introducing the student to the experimental techniques of organic chemistry.
Attribute: ENVS.
Corequisite: CHEM 2521.

CHEM 2532. ORGANIC CHEMISTRY LAB II FOR CHEM MAJORS. (2 Credits)
A continuation of CHEM 2531.
Attribute: ENVS.
Corequisite: CHEM 2522.
Prerequisite: CHEM 2531.

CHEM 2541. ORGANIC CHEMISTRY LAB I. (2 Credits)
(4-hour laboratory, 1-hour lecture) A laboratory course introducing the students to the experimental techniques of organic chemistry. Lab fee.
Corequisite: CHEM 2521.
Mutually Exclusive: NSCI 3821.

CHEM 2542. ORGANIC CHEMISTRY LAB II. (2 Credits)
(4-hour laboratory, 1-hour lecture) A continuation of CHEM 2541. Lab fee.
Prerequisite: CHEM 2541.
Mutually Exclusive: NSCI 3822.

CHEM 2900. INDEPENDENT STUDY-ORGANIC CHEMISTRY. (0 Credits)

CHEM 3031. SEMINAR AND RESEARCH I. (1 Credit)
Approval of mentor and of department chairperson required. Open to juniors only.
Attribute: ENVS.

CHEM 3032. SEMINAR AND RESEARCH II. (1 Credit)
Approval of mentor and of department chairperson required. Open to juniors only.

CHEM 3141. METHODS OF CHEMICAL RESEARCH. (3 Credits)
The art and practice of scientific data collection, its compilation and synthesis and its dissemination. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

CHEM 3621. PHYSICAL CHEMISTRY I. (4 Credits)
Outlines of physio-chemical principles, including introductions to quantum and statistical mechanics, reaction rates and the solid state. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Corequisite: CHEM 3631.
Prerequisite: CHEM 1322.

CHEM 3622. PHYSICAL CHEMISTRY II. (4 Credits)
A continuation of CHEM 3621, including classical thermodynamics and electrochemistry. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Attribute: ENVS.
Prerequisite: CHEM 3621.

CHEM 3631. PHYSICAL CHEMISTRY LAB I. (2 Credits)
A laboratory course that includes experimental determination of reaction rates and spectroscopic observations of quantum phenomena.
Corequisite: CHEM 3621.

CHEM 3632. PHYSICAL CHEMISTRY LAB II. (2 Credits)
A laboratory course in experimental thermodynamics and electrochemistry.
Attribute: ENVS.

CHEM 3721. QUANTITATIVE ANALYSIS. (4 Credits)
Fundamental theory of analytical chemistry including volumetric, gravimetric and spectrophotometric methods. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Attribute: ENVS.
Prerequisites: CHEM 1321 and CHEM 1322.

CHEM 3722. INSTRUMENTAL ANALYSIS. (4 Credits)
A lecture/laboratory course introducing the principles of chemical instrumentation, including instrument design and instrumental methods of chemical analysis. Topics include data generation, spectroscopic methods of analysis and separation techniques. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Attribute: ENVS.

CHEM 3990. DIRECTED RESEARCH. (1 Credit)
Students will work in the laboratory of a faculty mentor on an agreed upon project. Students will learn data collection, analysis, interpretation, and presentation techniques. Open to all majors. Sophomores, juniors, and seniors only. Registration only with permission of faculty mentor.

CHEM 4031. SEMINAR AND RESEARCH III. (1 Credit)
Approval of mentor and of department chairperson required. Open to seniors only.

CHEM 4032. SEMINAR AND RESEARCH IV. (1 Credit)
Approval of mentor and of department chairperson required. Open to seniors only.

CHEM 4221. BIOCHEMISTRY I. (3 Credits)
An introduction to the chemistry of biological polymers (carbohydrates, proteins, polynucleic acid), their monomeric constituents and lipids, emphasizing their biosynthesis and role as biostructural building blocks. Other specialized topics to be covered include enzyme kinetics, mechanism and regulation; energy conversion and dynamics; pre-biotic chemistry and theories of life's origin.
Prerequisite: CHEM 2522.
Mutually Exclusive: NSCI 4153.

CHEM 4222. BIOCHEMISTRY II. (4 Credits)
Chemistry of the main constituents of living matter, nature and mechanisms of biochemical processes, enzymes. Prerequisite organic chemistry. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
CHEM 4231. BIOCHEMISTRY LAB I. (1 Credit)
A laboratory course covering techniques used in the quantification, isolation and characterization of proteins, lipids, carbohydrates and nucleic acids. Exercises include spectrophotometry, chromatography, gel electrophoresis, protein assays, enzyme purification and kinetics, thermodynamic measurements, and DNA manipulations. 
Mutually Exclusive: NSCI 4853.

CHEM 4241. BIOMIMETIC CHEMISTRY. (3 Credits)
A study of biological polymers and molecular assemblies as molecular devices. The biological structures specifically adapted to catalysis, energy/signal transduction and mechanical behavior will be examined in the context of modern mimetic and supramolecular chemistry. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Prerequisite: CHEM 3721.

CHEM 4340. ENVIRONMENTAL CHEMISTRY. (4 Credits)
An introduction to environmental chemistry for science majors covering chemical phenomena in both the geosphere and anthrosphere. Lecture topics include descriptive chemistry of the environment, analytical procedures, and the technology of remediation. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.
Attribute: ENVS.

CHEM 4422. INORGANIC CHEMISTRY. (3 Credits)
A comprehensive course dealing with the chemistry, preparation and properties of common elements.
Prerequisites: CHEM 1322 or CHEM 3621.

CHEM 4432. INORGANIC CHEMISTRY LAB. (1 Credit)
A laboratory course to accompany CHEM 4422, including synthesis and characterization of inorganic compounds. Required of those students seeking ACS certification.

CHEM 4525. ORGANIC SYNTHESIS. (3 Credits)
An introduction to fundamental principles of synthetic problem solving. Emphasis will be on synthetically useful reactions and the basic approaches used to design a total synthesis. Topics include functional group transformations, construction of carbocyclic and acyclic systems, and synthesis of biologically interesting and naturally occurring molecules. A portion of the class time will be devoted to solving problems and devising syntheses.

CHEM 4625. COMPUTATIONAL CHEMISTRY AND APPLICATIONS IN MODERN DRUG DESIGN. (4 Credits)
An upper level course on computational techniques in chemistry. The course will provide introductions to molecular mechanics in small and large systems and computational approaches to quantum chemistry, including ab initio, semi-empirical, and DFT methods. The course will emphasize the applications of these techniques to pharmaceutical drug design in its modern practice. Following introductory exercises in the field, students will complete a small drug design or related project of their choosing. Basic background knowledge of physics, calculus, and chemistry are required, but formal experience in computer science or UNIX is not and the necessary skills in these areas will be taught in the course of the semester. Software used will include AMBER, GAMESS, and PHENIX. Four-credit courses that meet for 150 minutes per week require three additional hours of class preparation per week on the part of the student in lieu of an additional hour of formal instruction.

CHEM 4990. INDEPENDENT RESEARCH. (1-3 Credits)
Students will work with a faculty mentor on an agreed upon project. Students will cooperate with the faculty mentor on the project definition, data collection, analysis, interpretation, and the presentation of results. A comprehensive paper demonstrating a student’s accomplishments during independent research is required. Open to all majors. Juniors and seniors only. Registration only with permission of faculty mentor prerequisite: at least one semester of CHEM 3990 must be completed with a P grade. The course does not count as a chemistry major elective.
Prerequisite: CHEM 3990.

CHEM 4999. INDEPENDENT STUDY. (0-4 Credits)
Independent research and readings with supervision from a faculty member.