CHEMISTRY (CHEM)

Course Descriptions

CHEM 090 Introduction to Chemistry 3 Credit Hours
An introductory course in chemistry stressing fundamental principles of chemistry and the application of mathematics to chemistry and problem-solving. Topics will include chemical formulas and equations, stoichiometry, descriptive inorganic chemistry, behavior of gases and atomic structure. Students with high school chemistry and three years of high school mathematics should elect CHEM 114. Three hours lecture. (F).

CHEM 091 Introduction to Chemistry II 3 Credit Hours
The course is designed for the Chemistry 134/144 student whose background in chemistry is inadequate for success in 134/144. This course will be offered concurrently with Chem 090 (Introduction to Chemistry). It will begin after the first Chem 134/144 exam and will encompass the final nine weeks of the term. Topics will include chemical formulas and equations, stoichiometry, descriptive inorganic chemistry, behavior of gases, and atomic structure.

CHEM 100 Chemistry and Society 4 Credit Hours
An introductory course for nonscientists that examines the way chemistry impacts our world. The course will focus not only on what modern chemistry has accomplished, but more generally on the way scientists think and how they function. Topics include (a) air and water pollution, the ozone layer, global warming, acid rain, and other environmental chemistry; (b) the chemistry of plastics and polymers; (c) the chemistry of drugs and medicines; and (d) biochemistry and biotechnology. Other topics include the influence of the media on scientific issues and the decision-making process in science. Four hours lecture, three hours lab. (YR).

CHEM 134 General Chemistry IA 4 Credit Hours
An introduction to chemical phenomena and principles with an emphasis on developing both an understanding of chemistry. Students will investigate the fundamentals of chemistry in the context of real-world problems and will utilize systems of biological and environmental importance. Core concepts include stoichiometry, aqueous chemistry, gas laws, thermochemistry, atomic structure, molecular structure and bonding. Three hours lecture, one hour recitation, three hours laboratory. Primarily designed for students considering careers in life sciences or physical sciences. (F, S, W).
Prerequisite(s): MATH 100* or MATH 101* or MATH 1000* or MATH 1040* or MATH 104* or MATH 105* or MATH 113* or MATH 115* or Math Placement with a score of 105 or Math Placement with a score of 115
Corequisite(s): CHEM 134L

CHEM 136 General Chemistry IIA 4 Credit Hours
Continuation of CHEM 134. Concepts explored include conceptual and quantitative treatments of intermolecular forces, physical properties of solutions, chemical kinetics, chemical equilibria, acid-base equilibrium, thermodynamics, and electrochemistry. Primarily designed for students majoring in the physical sciences and the life sciences. (F,W,S)
Prerequisite(s): CHEM 134
Corequisite(s): CHEM 136L

CHEM 225 Organic Chemistry I 4 Credit Hours
The initial course in organic chemistry. A general introduction to organic chemistry with emphasis on the development of structure theory and functional group chemistry. Three hours lecture, one hour recitation. (F, W, S).
Prerequisite(s): CHEM 136 or CHEM 146

CHEM 226 Organic Chemistry II 4 Credit Hours
A continuation of CHEM 225. Topics include functional group chemistry and properties of carbohydrates, amino acids, and aromatic compounds. Three hours lecture, one hour recitation. CHEM 225 and 226 constitute a two-semester sequence in organic chemistry, suitable for students in the basic sciences or engineering or with interests in one of the health professions. (F, W, S).
Prerequisite(s): CHEM 225

CHEM 227 Organic Chemistry Laboratory 2 Credit Hours
Development of the basic laboratory techniques of organic chemistry. The chemistry of functional groups is studied and various organic compounds are synthesized and purified. Eight hours laboratory. (F,W,S).
Prerequisite(s): CHEM 226*

CHEM 228 Org Chem Lab for Chem/Bchm 2 Credit Hours
CHEM 228 incorporates chemical reactions and techniques for the synthesis, purification, and characterization of organic molecules. Students will conduct modern organic chemical experiments, collect data using modern instrumentation, analyze that data, and explain their reasoning in written and visual formats. Students will learn techniques to conduct multi-step synthesis, isolation, and purification of organic molecules and use modern techniques for molecular structure elucidation and to analyze pure samples and mixtures. This course is aimed at students majoring in chemistry or biochemistry. Students cannot receive credit for both CHEM 227 and CHEM 228. (F,W)
Prerequisite(s): ((CHEM 134 and CHEM 136) or (CHEM 144 and CHEM 146)) and CHEM 225 and CHEM 226*
Restriction(s):
Can enroll if Major is Chemistry (ACS Certified), Biochemistry

CHEM 285 Introduction to Glass Blowing 1 Credit Hour
A study of the nature, properties, and manufacture of glass. Laboratory experience in the manipulation of glass and the construction of scientific apparatus. Discussions, laboratory, and field trips. (AY).

CHEM 303 Inorganic Chemistry I 4 Credit Hours
A study of the chemistry of the elements and their periodic relationship. Bonding theories and structures as well as descriptive chemistry of the representative elements will be emphasized. Three hours lecture. (F).
Prerequisite(s): CHEM 136 or CHEM 146

CHEM 325 Principles of Organic Chem 3 Credit Hours
A one-semester introduction to the compounds of carbon, with an emphasis on structure, preparation, reactivity and characterization of different functional groups. Both aliphatic and aromatic compounds will be examined. The important role of organic compounds in modern society will be highlighted with real world examples including fuels, detergents, plastics, medicines, biomolecules, environmental pollutants and additives. This course may not be used to satisfy the organic chemistry prerequisite for the Biochemistry, Biology, Chemistry, or Microbiology degree programs. Students may not receive credit for both CHEM 225 and 325. CHEM 325 may not be used as a prerequisite for Chemistry 226.
Prerequisite(s): CHEM 124 and (CHEM 136 or CHEM 146)
Restriction(s):
Cannot enroll if Major is Microbiology, Chemistry (ACS Certified), Chemistry (Instructional), Biochemistry, Biological Sciences

CHEM 343 Analytical Chemistry for Life Sciences 4 Credit Hours
Analytical chemistry is a branch of chemistry focused on identification and quantitation of the chemical substances in a sample. This course introduces students to the basic principles and methods of analytical chemistry. Emphasis will be placed on quantitative analysis, various laboratory techniques, and evaluation of error and uncertainty in measurements using statistical tools. Students will learn fundamentals of analytical chemistry and explore a wide range of laboratory techniques, including volumetric and gravimetric analysis, spectroscopic and electrometric analysis, atomic spectrometry, chromatography and mass spectrometry. Through lectures and hands-on laboratory practice, students will develop the skills necessary to perform laboratory experiments, collect, analyze, and interpret chemical data relevant to fields such as environmental science, life sciences, and forensic studies. (F).
Prerequisite(s): CHEM 136
Restriction(s):
Cannot enroll if Major is Chemistry (ACS Certified)

CHEM 344 Quantitative Analysis 4 Credit Hours
A survey of theory and practice of volumetric, gravimetric, electrometric and colorimetric analysis. Systematic analysis of complex materials. Two hours lecture, eight hours laboratory. (F).
Prerequisite(s): CHEM 136 or CHEM 146
Corequisite(s): CHEM 344L

CHEM 348 Environmental Chemistry 4 Credit Hours
Description of the concepts, principles, practices, and current problems in the chemistry of natural waters, the soil, and the atmosphere. (W, AY).
Prerequisite(s): CHEM 134 and CHEM 136

CHEM 349 Environmental Chem Laboratory 1 Credit Hour
Collection and analysis of air, water, soil, and organisms for pollutants such as noxious gases, heavy metals, and trace organics. EPA-approved methods are emphasized. Four hours laboratory. (AY).
Prerequisite(s): CHEM 348* or ESCI 348*

CHEM 350 Physical Chemistry for Life Sciences 4 Credit Hours
CHEM 350 introduces the principles of physical chemistry most relevant to the life sciences and pre-health fields. Topics include thermodynamics, equilibria, acid–base chemistry and buffers, kinetics, electrochemistry, solutions, and spectroscopy. The course emphasizes biomedical applications and exam preparation (MCAT, DAT, OAT). Mathematical treatment uses algebra, logarithms, exponents, ratios, and graphical analysis, but does not require calculus. (F, W, AY).
Prerequisite(s): BIOL 140 and CHEM 134 and CHEM 136 and (MATH 101 or MATH 105 or MATH 115)
Restriction(s):
Cannot enroll if Major is Chemistry (ACS Certified), Biochemistry

CHEM 352 Introduction to Toxicology 3 Credit Hours
An introduction to the principles of toxicology with an emphasis on environmental toxicology. Major topics include toxic agents, toxicological mechanisms, and use of toxicological reference literature. Discussion of chemical carcinogenesis, genetic toxicology, immunotoxicology, teratology, and toxic responses of the skin, eyes and nervous system. Three hours lecture. (AY,W).
Prerequisite(s): CHEM 225

CHEM 368 Physical Chemistry I 4 Credit Hours
Nature of the gaseous state, chemical thermodynamics, biochemical and chemical equilibria, Chemical kinetics, Chemical equilibrium, and statistical thermodynamics. Four hours lecture. (W).
Prerequisite(s): CHEM 225 and MATH 115 and (PHYS 125 or PHYS 150)

CHEM 370 Principles of Biochemistry 4 Credit Hours
A concise yet comprehensive survey of biochemistry designed for non-biochemistry majors. The structure of biological molecules and enzyme - catalyzed events are presented in a eukaryotic cellular context. Topics include the structure of macromolecules, enzymology, bioenergetics, regulation, intermediary metabolism, signaling, and the flow of cellular information from DNA to RNA to proteins. Homeostasis and evolution are overarching concepts. Students cannot take both BCHM 370 and 470 or 471 for any combination of concentration, cognate or minor requirement. Four hours lecture. (F).
Prerequisite(s): BIOL 140 and CHEM 226

CHEM 390 Current Topics in Chemistry 1 to 3 Credit Hours
A course in special topics current to the field of chemistry. Topics and format for the course may vary. See current Schedule of Classes. One to three hours seminar. Permission of instructor. (OC).

CHEM 397 Current Topics in Chemistry 3 Credit Hours
A course for non-science majors which focuses on the interaction of chemistry and society. Sufficient chemical knowledge will be introduced so that the issues can be discussed and competing statements evaluated. Topics covered will include air and water pollution, fuels, designing drugs, etc. (OC).

CHEM 403 Inorganic Chemistry II 4 Credit Hours
A study of coordination and organometallic compounds through the use of current theories. The structure, reactivity, and descriptive chemistry of transition metal complexes will be examined. Three hours lecture. (W).
Prerequisite(s): CHEM 303 and (CHEM 368* or CHEM 468)

CHEM 426 Advanced Organic Chemistry 4 Credit Hours
Spectral analysis, structure determination, reaction mechanisms, synthesis, stereochemistry, and other selected topics are discussed. Three hours lecture. (F, AY).
Prerequisite(s): CHEM 226 and CHEM 227

CHEM 430 Bioinorganic Chemistry 4 Credit Hours
This course examines the roles that metals play in biological systems, including the chemical principles that make metal ions well-suited for roles in protein structure, in redox catalysis and in acid base chemistry. The physical and experimental techniques that are applied to explore the structure and function of metals in natural systems will be introduced using case studies from the primary scientific literature iin the field. BCHM 370 or its quivalent are strongly recommended but not required. (F, AY).
Prerequisite(s): CHEM 136 and BIOL 140

CHEM 435 Green Chemistry 4 Credit Hours
An examination of green chemistry principles and methods used to assess and improve chemical processes with respect to environmental impact. Topics include: concepts of green chemistry, waste prevention, catalysis, renewable resources, alternative energy resources, and green technologies. (F, AY).
Prerequisite(s): CHEM 226 or CHEM 325
Restriction(s):
Cannot enroll if Class is Graduate

CHEM 436 Polymer Chemistry 4 Credit Hours
The macromolecular concept is introduced and polymerization mechanisms are discussed. The chemistry and physical properties of representative polymeric materials are presented. Topics include the determination and distribution of molecular weights, polymer morphology, mechanical properties of polymers, relaxation phenomena in polymers, and methods of polymer characterization. Three hours lecture. (OC).
Prerequisite(s): CHEM 226 and (CHEM 368* or CHEM 468)

CHEM 437 Nano-Biotechnology 4 Credit Hours
An introduction to the fundamentals of nanotechnology, nano-fabrication processes and its application in different fields with special attention to the life sciences. This course introduces different tools used in nontechnology and investigates how one can borrow the idea of self-assembly from nature to design structures at the nanometer scale. The course also focuses on different contemporary application areas of nanotechnology like biosensor development, cancer research and drug delivery. The research areas of selected companies that are applying nanotechnology to develop new products will also be explored. This course showcases the interchange of ideas between chemistry, materials science and engineering in solving complex biological problems. (W, AY).
Prerequisite(s): (CHEM 136 or CHEM 146) and (PHYS 126 or PHYS 151) and BIOL 140
Restriction(s):
Can enroll if Class is Junior or Senior

CHEM 438 Medicinal Chemistry: Drug Design & Development 4 Credit Hours
Medicinal chemistry concerns the discovery, the development, the identification and the interpretation of the mode of action of biologically active compounds at the molecular level. Emphasis is put on drugs, but the interests of the medicinal chemist are not restricted to drugs but include bioactive compounds in general. Medicinal chemistry is also concerned with the study, identification, and synthesis of the metabolic products of these drugs and related compounds. Our objective is to begin to understand the relationship between chemical structures, chemical and physical properties, and biological activity. We will learn to apply these relationships to understand the behavior of individual drugs and to understand the process of drug discovery and design. An understanding of basic and organic chemistry principles is essential to success in this course. (W).
Prerequisite(s): CHEM 225 and CHEM 226

CHEM 447 Instrumental Methods of Analys 4 Credit Hours
A study of the theory, operation, and application of instrumental methods of chemical analysis including optical, magnetic, electrochemical, and separation techniques. Two hours lecture, eight hours laboratory. (W).
Prerequisite(s): CHEM 344

CHEM 453 Advanced Synthesis and Characterization Laboratory – Research Experience 4 Credit Hours
Synthesis of compounds that would illustrate recent developments in different organic and inorganic chemistry areas. Advanced techniques, including but not limited to spectroscopy and chromatography, will be applied to compound characterization and data collection and interpretation. Extensive formal writing and data dissemination are critical components of the course. Poster and oral presentation are required. Four credits laboratory. (W).
Prerequisite(s): CHEM 227 and CHEM 226 and CHEM 447

CHEM 469 Physical Chemistry II 4 Credit Hours
From classical to quantum mechanics, quantum theory, using quantum mechanics on a simple system, particles in a box and the real world, the quantum mechanical model for the vibration and rotation of molecules, atomic and molecular structure, the hydrogen atom, electronic and molecular spectroscopy; four hours of lecture. (F).
Prerequisite(s): CHEM 368

CHEM 470 Biochemistry I 4 Credit Hours
Biochemistry I explores the structure/function relationships of the four major types of biomolecules, including carbohydrates, nucleic acids, and lipids, with an emphasis on proteins and enzyme kinetics. (F).
Prerequisite(s): BIOL 130 and BIOL 140 and CHEM 226

CHEM 471 Biochemistry II 4 Credit Hours
BCHM 471 delves into advanced biochemical processes vital to life. Covering biomolecule structure and function, enzymatic reactions, metabolic pathways, and cellular signaling, the course starts with life's chemical basis and progresses to complex biochemical topics. It emphasizes practical skills like data analysis, problem-solving, and biochemical research techniques. Students undertake a research project on a biochemical disease and an oral presentation on recent biochemical research, enhancing their independent research and communication skills. This course prepares students for advanced academic or professional roles in biochemistry. (W).
Prerequisite(s): BCHM 470 or CHEM 470 or BIOL 470

CHEM 472 Biochemistry Laboratory I 2 Credit Hours
Biochemistry Laboratory I combines a blend of theoretical knowledge and hands-on experience. Students will explore advanced biochemical techniques including chromatography, gel electrophoresis, and spectroscopy. The course also includes molecular biology techniques such as site-directed mutagenesis. Aimed at fostering critical thinking, problem-solving, and scientific communication, BCHM 472 prepares students for advanced roles in biochemistry and medical research, emphasizing the application of laboratory skills to real-world challenges in personalized medicine. (F).
Prerequisite(s): (BIOL 470* or BCHM 470* or CHEM 470*) and BCHM 210

CHEM 473 Biochemistry Laboratory II 2 Credit Hours
This advanced laboratory class further develops experimental skills to examine receptors, ligands, and signal cascades. These cellular factors are critical to metabolic homeostasis, gene regulation and neurochemistry. This course will teach skills and techniques to understand drug development, signaling, biochemical assays, genomics, and ligand binding affinity, specificity, and competition. (W).
Prerequisite(s): (BCHM 471* or BIOL 471* or CHEM 471*) and (BCHM 472 or BIOL 472 or CHEM 472)

CHEM 481 Physicochemical Measurements 2 Credit Hours
This course requires laboratory work including measurements of properties of pure liquids and solutions, studies of phase equilibria, thermochemical measurements, and analysis of atomic and molecular spectra. Eight hours laboratory. (F).
Prerequisite(s): CHEM 469*

CHEM 490 Topics in Chemistry 1 to 3 Credit Hours
Examination of problems and issues in selected areas of chemistry. Title as listed in Schedule of Classes will change according to content. Course may be repeated for credit when specific topics differ. One to three hours lecture. (YR).
Prerequisite(s): CHEM 226
Restriction(s):
Can enroll if Class is Junior or Senior or Graduate

CHEM 490D Topics in Chemistry 3 Credit Hours
Topic: Bioinorganic Chemistry. Introduces the roles metals play in biological systems. Explores chemical principles that make metals particularly well suited for these roles. Introduces physical and experimental techniques used to explore the structure and function of metals in natural systems. Explores case studies from the literature to synthesize results of various experiments to develop a final understanding of the systems. Students will not receive credit for both CHEM 490D and 590B.
Prerequisite(s): CHEM 226 and BIOL 140

CHEM 495 Off-Campus Research Participat 1 to 3 Credit Hours
Participation in ongoing experimental research at an off-campus laboratory. Arrangements made between the research laboratory, the student and the chemistry concentration advisor. No more than six hours combined from CHEM 495, 498, and 499 may be credited toward the 120 hours required for a degree. Four to twelve hours laboratory. Permission of concentration advisor. (F,W,S).

CHEM 497 Seminar in Chemistry 1 Credit Hour
Weekly seminars on topics of current chemical interest presented by faculty members, guest lecturers or students. The subject will vary from term to term. The course may be elected up to three times. One hour seminar. (W).
Restriction(s):
Can enroll if Class is Junior or Senior or Graduate
Cannot enroll if Major is Chemistry (Instructional), Chemistry (ACS Certified)

CHEM 498 Readings in Chemistry 1 to 3 Credit Hours
Library research in a specific area of chemistry performed under the guidance of a faculty member. No more than six hours combined from CHEM 495, 498 and 499 may be credited toward the 120 hours required for a degree. Four to twelve hours of readings. Permission of instructor. (F,W,S).

CHEM 499 Laboratory Research in Chem 1 to 3 Credit Hours
Directed laboratory research performed under the guidance of a faculty member. No more than six hours combined from CHEM 495, 498 and 499 may be credited towards the 120 hours required for a degree. Four to twelve hours laboratory. Permission of instructor. (F,W,S).

*An asterisk denotes that a course may be taken concurrently.

Frequency of Offering

The following abbreviations are used to denote the frequency of offering: (F) fall term; (W) winter term; (S) summer term; (F, W) fall and winter terms; (YR) once a year; (AY) alternating years; (OC) offered occasionally