

# CHEMISTRY (CHM)

## CHM 101 Chemistry for Allied Health (3 credits)

This course introduces topics in both general and organic chemistry, including atomic structure, dimensional analysis, the mole, organic nomenclature, chemistry of gases, and introduces equilibrium. Students who register for CHM 101 must also register for a CHM 101 laboratory. For example, if you register for CHM 101 you must, at the same time, register for a section of CHM 101L.

## CHM 101L Chemistry Allied Health Lab (0 credits)

Students who register for CHM 101 must also register for a CHM 101 laboratory. For example, if you register for CHM 101 you must, at the same time, register for a section of CHM 101L.

## CHM 112 Food Chemistry (4 credits)

The study of chemistry as it specifically relates to food. Underlying basic chemical principles will allow the study of particular molecules found in food (carbohydrates, proteins, lipids) and the changes these molecules undergo as they are cooked and absorbed. Topics will also include preservation, food safety, and food additives. This laboratory course will introduce students to the use of laboratory techniques to study food, including the measurement of food properties including pH, flavor, color, and texture. Students will learn how chemical and physical changes can alter food quality. Students who register for CHM 112 must also register for a CHM 112 laboratory. For example, if you register for CHM 112 you must, at the same time, register for a section of CHM 112L.

*Attributes:* CCC: Natural Science, GEP: Natural Science, GEP: Science Course w/Lab, Undergraduate

## CHM 112L Food Chemistry: Lab (0 credits)

Students who register for CHM 112 must also register for a CHM 112 laboratory. For example, if you register for CHM 112 you must, at the same time, register for a section of CHM 112L.

*Attributes:* CCC: Natural Science, GEP: Natural Science, Undergraduate

## CHM 118 Chemical Sciences Orientation (1 credit)

Introduction to all aspects of the chemical sciences, including biochemistry. Students are presented with an overview of the department, the University, the curricula, active research areas, career opportunities, and scientific ethics, as well as information on how they can maximize their educational experience.

*Attributes:* Undergraduate

## CHM 120 General Chemistry I (3 credits)

Topics included are chemical formulas, stoichiometry, balancing reactions, ideal gases, thermodynamics, atomic structure, chemical bonding and molecular structure, kinetics, equilibrium, the chemistry of acids and bases, entropy, free energy, and electrochemistry. Students who register for CHM 120 must also register for a CHM 120 laboratory. For example, if you register for CHM 120 you must, at the same time, register for a section of CHM 120L.

*Attributes:* CCC: Natural Science, GEP: Natural Science, GEP: Science Course w/Lab, Undergraduate

## CHM 120L General Chemistry Lab I (1 credit)

A laboratory course to accompany CHM 120 with emphasis upon concepts in chemistry, quantitative and qualitative analysis, and introduction to instrumental methods. One four-hour period. Students who register for CHM 120 must also register for a CHM 120 laboratory. For example, if you register for CHM 120 you must, at the same time, register for a section of CHM 120L.

*Attributes:* CCC: Natural Science, GEP: Natural Science, Undergraduate

## CHM 125 General Chemistry II (3 credits)

Topics included are chemical formulas, stoichiometry, balancing reactions, ideal gases, thermodynamics, atomic structure, chemical bonding and molecular structure, kinetics, equilibrium, the chemistry of acids and bases, entropy, free energy, and electrochemistry. Students who register for CHM 125 must also register for a CHM 125 laboratory. For example, if you register for CHM 125 you must, at the same time, register for a section of CHM 125L.

*Prerequisites:* CHM 120 or CHM 121 or CH 101 or CH 111

*Attributes:* GEP: Science Course w/Lab, Undergraduate

## CHM 125L General Chemistry Lab II (1 credit)

A laboratory course to accompany CHM 125 with emphasis upon concepts in chemistry, quantitative and qualitative analysis, and introduction to instrumental methods. One four-hour period. Students who register for CHM 125 must also register for a CHM 125 laboratory. For example, if you register for CHM 125 you must, at the same time, register for a section of CHM 125L.

*Prerequisites:* CHM 120L or CH 103 or CH 113

*Attributes:* Undergraduate

## CHM 170 Special Topics in Chemistry (1-4 credits)

Advanced study on a topic that is arranged with a Chemistry faculty member.

*Attributes:* Undergraduate

## CHM 170L Special Topics Lab (2 credits)

Lab component for advanced study on a topic that is arranged with a Chemistry faculty member.

*Attributes:* Undergraduate

## CHM 204 Literature of Chemistry (1 credit)

The study of the nature and uses of the primary, secondary, and tertiary literature of chemistry and biochemistry and of modern information-retrieval techniques. Students who register for CHM 204 must also register for CHM 210.

*Attributes:* Undergraduate

## CHM 210 Organic Chemistry I (3 credits)

Modern organic chemistry in which the treatment of aliphatic and aromatic compounds is integrated as much as possible. Reactions of the functional groups are explained in terms of electronic mechanisms. Students who register for CHM 210 must also register for a CHM 210 laboratory. For example, if you register for CHM 210 you must, at the same time, register for a section of CHM 210L.

*Prerequisites:* CHM 125 or CHM 126 or CH 102 or CH 112

*Attributes:* Undergraduate

## CHM 210L Organic Chemistry Lab I (1 credit)

This semester concentrates on experiments designed to introduce students to the various techniques used in the organic laboratory. Students who register for CHM 210 must also register for a CHM 210 laboratory. For example, if you register for CHM 210 you must, at the same time, register for a section of CHM 210L.

*Prerequisites:* CHM 125L or CH 114 or CH 104

*Attributes:* Undergraduate

## CHM 215 Organic Chemistry II (3 credits)

Modern organic chemistry in which the treatment of aliphatic and aromatic compounds is integrated as much as possible. Reactions of the functional groups are explained in terms of electronic mechanisms. Students who register for CHM 215 must also register for a CHM 215 laboratory. For example, if you register for CHM 215 you must, at the same time, register for a section of CHM 215L.

*Prerequisites:* CHM 210 or CH 201 or CH 211

*Attributes:* Undergraduate

**CHM 215L Organic Chemistry Lab II (1 credit)**

A continuation of CHM 210L utilizing micro scale laboratory techniques in organic chemistry for the preparation, purification and analysis of organic compounds. Students who register for CHM 215 must also register for a CHM 215 laboratory. For example, if you register for CHM 215 you must, at the same time, register for a section of CHM 215L.

*Prerequisites:* CHM 210L or CH 203 or CH 213

*Attributes:* Undergraduate

**CHM 230 Basic Inorganic Chemistry (3 credits)**

Introduction to basic inorganic chemistry, including elementary bonding theories, the chemistry of elements other than carbon, coordination chemistry, acid-base chemistry, organometallic chemistry, and solid-state chemistry.

*Prerequisites:* (CH 102 or CH 112 or CHM 125) and (CH 104 or CH 114 or CHM 125L)

*Attributes:* Undergraduate

**CHM 270 Special Topics in Chemistry (3 credits)**

Advanced study on a topic that is arranged with a Chemistry faculty member.

*Attributes:* Undergraduate

**CHM 300 Discussions in Chemistry (1 credit)**

Discussion of ethical issues and research opportunities in the chemical sciences as well as career planning.

*Attributes:* Undergraduate

**CHM 310 Physical Chemistry I (3 credits)**

Covers thermodynamic principles and applications to gases, liquids, and ideal and non-ideal solutions; thermodynamics of chemical reactions and equilibria, electrochemistry and reaction kinetics.

*Prerequisites:* CHM 215

*Attributes:* Undergraduate

**CHM 310L Physical Chemistry Lab I (2 credits)**

Experiments are performed to reinforce the concepts learned in CHM 310

*Attributes:* Undergraduate

**CHM 315 Physical Chemistry II (3 credits)**

Quantum Chemistry. The fundamental postulates of quantum mechanics are introduced in the form of historical narrative to illustrate the logical progression to quantization in natural theory. Eigenvalue problems, operator mathematics, uncertainties and orthonormality are discussed as essential portions of quantum mechanical calculations. The Schrodinger equations for the harmonic oscillator and rigid rotor are solved and related specifically to molecular spectroscopy techniques. The course ends with the description of the hydrogen atom in terms of quantum mechanics, with emphasis on the origin of the familiar atomic orbitals.

*Prerequisites:* CHM 310

*Attributes:* Undergraduate

**CHM 318 Essentials of Physical Chem (4 credits)**

Fundamental concepts of physical chemistry: aspects of thermodynamics including the first and second laws, chemical and phase equilibria, solutions, surface chemistry, reaction kinetics, introduction to quantum chemistry including QM postulates/Schrodinger equation/particle in a box, rigid rotor and harmonic oscillator/hydrogen atom/many electron atom, chemical bond, molecular structure, introduction to statistical mechanics including Boltzmann distribution/partition functions.

*Prerequisites:* PY 212 or PHY 212

*Attributes:* Undergraduate

**CHM 320 Physical Chem for Chem Bio (3 credits)**

Study of atomic and molecular structure; chemical thermodynamics; states of matter; kinetics and mechanisms of reactions; phase and chemical equilibria; emphasis on applications in biological systems.

*Prerequisites:* CHM 215

*Attributes:* Undergraduate

**CHM 322 Physical Chemistry II (4 credits)**

Part of Physical Chemistry Sequence, includes quantum chemistry, reaction kinetics, spectroscopy, photochemistry, statistical mechanics, and theories of reaction rates.

*Prerequisites:* CHM 215

*Attributes:* Undergraduate

**CHM 330 Instrumental Analysis (3 credits)**

This course covers the theory, methodology, and instrumentation for the study of atomic and molecular species and/or processes. Students who register for CHM 330 must also register for a CHM 330 laboratory. For example, if you register for CHM 330 you must, at the same time, register for a section of CHM 330L.

*Prerequisites:* CHM 215

*Attributes:* Undergraduate

**CHM 330L Instrumental Analysis Lab (2 credits)**

Students who register for CHM 330 must also register for a CHM 330 laboratory. For example, if you register for CHM 330 you must, at the same time, register for a section of CHM 330L.

*Prerequisites:* CHM 215L

*Attributes:* Undergraduate

**CHM 340 Biochemistry (3 credits)**

A basic introduction to the chemistry of living systems emphasizing their major metabolic activities. Structure and function of proteins, lipids, and carbohydrates. Basic principles of intermediary metabolism and photosynthesis.

*Prerequisites:* CHM 215

*Attributes:* Undergraduate

**CHM 340L Biochemistry Lab (2 credits)**

Students who register for CHM 340 Lab must also register for a CHM 340. For example, if you register for CHM 340L you must, at the same time, register for a section of CHM 340.

*Prerequisites:* CHM 215L

*Attributes:* Undergraduate

**CHM 341 Molecular Structure Biochemist (3 credits)**

This introduction to biochemistry covers protein structure and function, enzyme kinetics and mechanisms, membrane structure and function, and principles of biological regulation.

*Prerequisites:* CH 212 or CH 202 or CHM 215

*Attributes:* Undergraduate

**CHM 342 Nucleic Acid Biochemistry (3 credits)**

Focused on molecular genetics. Topics include structure, replication, transcription, translation, repair, recombination, and processing of nucleic acids; control of gene expression; and modern recombinant methods of DNA splicing, cloning, and sequencing.

*Prerequisites:* CH 341 and BS 462 and BS 462L

*Attributes:* Undergraduate

**CHM 343 Metabolic Biochemistry (3 credits)**

Catabolic and anabolic pathways with emphasis on chemical logic, mechanisms, and regulatory control. Also includes carbohydrate, lipid, amino acid, and nucleotide metabolism, and oxidative and photosynthetic phosphorylation.

*Prerequisites:* CHM 340 or CHM 341

*Attributes:* Undergraduate

**CHM 350 Inorganic Chemistry (3 credits)**

This course includes the study of atomic structure, bonding, molecular orbital theory, symmetry and group theory, the chemistry of the main group elements, and the structure and reactivity of transition metal complexes. Students who register for CHM 350 must also register for a CHM 350 laboratory. For example, if you register for CHM 350 you must, at the same time, register for a section of CHM 350L.

*Prerequisites:* CHM 215 or CH 212 or CH 331

*Attributes:* Undergraduate

**CHM 350L Inorganic Chemistry Lab (2 credits)**

Students who register for CHM 350 must also register for a CHM 350 laboratory. For example, if you register for CHM 350 you must, at the same time, register for a section of CHM 350L.

*Prerequisites:* CHM 215L

*Attributes:* Undergraduate

**CHM 360 Nanochemistry (3 credits)**

This course covers the synthesis, characterization and physical properties of materials chemistry systems on the length scale of individual molecules. Emphasis is placed on the distinction between macro- and nanoscale properties of matter. Course topics to include (but not limited to): quantum confinement in semiconductor nanocrystals; localized surface plasmon resonance (LSPR), superhydrophobicity in self-assembled monolayers; electronic and mechanical properties of 2D materials

*Prerequisites:* CHM 215 and (MAT 161 or MAT 155) and (PHY 102 (may be taken concurrently) or PHY 106 (may be taken concurrently))

*Attributes:* Undergraduate

**CHM 361 Analytical Chemistry (3 credits)**

Introductory analytical chemistry with emphasis on relevant chemical principles, combining both classical and modern instrumental techniques. Students who register for CHM 361 must also register for a CHM 361 laboratory. For example, if you register for CHM 361 you must, at the same time, register for a section of CHM 361L.

*Prerequisites:* (CH 102 or CH 112 or CHM 125) and (CH 104 or CH 114 or CHM 125L)

*Attributes:* Undergraduate

**CHM 361L Analytical Chemistry Laboratory (1 credit)**

Students who register for CHM 361 must also register for a CHM 361 laboratory. For example, if you register for CHM 361 you must, at the same time, register for a section of CHM 361L.

*Prerequisites:* CH 104 or CH 114 or CHM 125L

**CHM 370 Special Topics in Chemistry (3 credits)**

Advanced study on a topic that is arranged with a Chemistry faculty member.

*Attributes:* Undergraduate

**CHM 390 Chemistry Seminar (0 credits)**

Lectures by outside and local speakers and discussions of special topics in chemistry. Enrollment is required each semester for junior and senior chemistry majors.

*Attributes:* Undergraduate

**CHM 401 Seminar in Chemistry I (1 credit)**

Chemical and biochemical topics of current interest presented orally by students and invited guest speakers. Writing, speech, delivery, and use of visual aids are critiqued. All biochemistry, chemistry, and pharmaceutical chemistry majors, and other interested persons are invited to attend.

*Attributes:* Undergraduate

**CHM 402 Seminar in Chemistry II (1 credit)**

Lectures by outside and local speakers and discussions of special topics in Chemistry

*Prerequisites:* CH 401 or CHM 401

*Attributes:* Undergraduate

**CHM 410 Biophysical Chemistry (3 credits)**

This course covers the physical equilibria, electrochemical, and kinetic properties of biological reactions

*Prerequisites:* CHM 310 or CHM 320

*Attributes:* Undergraduate

**CHM 411 Medicinal Chemistry (3 credits)**

A study of the biochemical mechanisms of drug action in order to develop a rational approach to the analysis of drugs and their metabolites and to design new drugs.

*Prerequisites:* CH 341 or CHM 341

*Attributes:* Undergraduate

**CHM 414 Structure-Activity Relationships (3 credits)**

Selected classes of medicinal agents are examined, stressing general structures, synthesis, and, in particular, the relationships between structure and pharmacological activity.

*Prerequisites:* CH 212 or CHM 215

*Attributes:* Undergraduate

**CHM 420 Atmospheric Environmental Chem (3 credits)**

This course examines the behavior of chemical species in the atmosphere. Topics include: stratospheric chemistry and the role of ozone, tropospheric chemistry and photochemical smog formation, precipitation, aerosol chemistry, indoor and urban air quality and regulatory efforts, energy, the chemistry of global climate and potential mitigation strategies, biogeochemical cycling of elements, and green chemistry.

*Prerequisites:* CHM 215

*Attributes:* Undergraduate

**CHM 430 Mechanisms in Organic Chem (3 credits)**

Application of the electron pushing formalism for manipulating Lewis structure representations of organic structures. Emphasis is placed on mechanistic rationalization of complex organic transformations. Classes of mechanisms include elimination, substitution, rearrangement, oxidation-reduction, enolate alkylation, and others.

*Prerequisites:* CHM 215

*Attributes:* Undergraduate

**CHM 440 Organometallic Chemistry (3 credits)**

This course will focus on the structure and reactivity of organometallic transition metal complexes. Topics include catalysis, reaction mechanisms, applications to organic chemistry, and characterization by spectroscopic methods.

*Prerequisites:* CHM 350

*Attributes:* Undergraduate

**CHM 444L Biochemistry Laboratory I (1 credit)**

Techniques of isolation, purification, and assay of representative biomolecules, particularly proteins.

*Prerequisites:* (CH 341 or CHM 341)

*Attributes:* Undergraduate

**CHM 445L Biochemistry Laboratory II (1 credit)**

This laboratory course focuses on advanced biochemical techniques for the analysis of proteins, nucleic acids, and metabolites. Experiments include enzyme kinetics, chromatography, electrophoresis, and spectroscopic methods for biomolecular characterization. Students will gain hands-on experience in experimental design, data collection, and interpretation of biochemical assays.

*Prerequisites:* CH 444 and BS 462 or BIO 462 (may be taken concurrently)

*Attributes:* Undergraduate

**CHM 448 Computer Aided Drug Design (3 credits)**

Introduction to the theory and practice of molecular modeling, especially as applied to the problem of identifying and designing bioactive and therapeutic agents, using specialized software and advanced computer hardware such as workstations and supercomputer clusters.

*Prerequisites:* CH 341

*Attributes:* Undergraduate

**CHM 450 Polymer Chemistry (3 credits)**

This course explores the fundamental principles of polymer science, including polymer synthesis, structure, and properties. Topics include step-growth and chain-growth polymerization, molecular weight distribution, viscoelasticity, thermal properties, and applications of polymers in industry and medicine. Special emphasis is placed on the relationship between molecular structure and macroscopic material properties.

*Prerequisites:* CHM 310

*Attributes:* Undergraduate

**CHM 460 Water Chemistry (3 credits)**

This course examines the behavior of chemical species in natural and engineered water systems and their interactions with the terrestrial environment. Topics include: the chemical composition of surface and subsurface water; geochemical controls on water composition; equilibrium and kinetic processes in aquatic systems; fate and reactions of inorganic and organic constituents in water; acid-base chemistry, complexation chemistry, and redox chemistry in water; the applications of isotopic and other tracers in the study of aquatic systems; water pollution and treatment.

*Prerequisites:* CHM 215

*Attributes:* Undergraduate

**CHM 470 Special Topics (3 credits)**

Advanced study on a topic that is arranged with a chemistry faculty member. Permission of the Department of Chemistry chair is required.

*Attributes:* Undergraduate

**CHM 480 Inorganic Biochemistry (3 credits)**

The chemical and biological properties of various metal ions in biological systems will be examined at the molecular level. Permission of the Department of Chemistry chair is required.

*Prerequisites:* CHM 215 and CHM 340

*Attributes:* Undergraduate

**CHM 491 Chemistry Internship I (3 credits)**

An approved internship in chemistry.

*Attributes:* Undergraduate

**CHM 492 Chemistry Internship II (3 credits)**

An approved internship in chemistry.

*Attributes:* Undergraduate

**CHM 495 Undergraduate Research (1-3 credits)**

Qualified students may elect to carry out research in analytical, inorganic, organic, or physical chemistry or biochemistry under the direction of a member of the department.

**CHM 510 Organic Chemistry I (3 credits)**

Modern organic chemistry in which the treatment of aliphatic and aromatic compounds is integrated as much as possible. Reactions of the functional groups are explained in terms of electronic mechanisms.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 515 Organic Chemistry II (3 credits)**

Modern organic chemistry in which the treatment of aliphatic and aromatic compounds is integrated as much as possible. Reactions of the functional groups are explained in terms of electronic mechanisms.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 520 Essentials Physical Chemistry (3-4 credits)**

Fundamental concepts of physical chemistry: aspects of thermodynamics including the first and second laws, chemical and phase equilibria, solutions, surface chemistry, reaction kinetics, introduction to quantum chemistry including QM postulates/Schrodinger equation/particle in a box, rigid rotor and harmonic oscillator/hydrogen atom/many electron atom, chemical bond, molecular structure, introduction to statistical mechanics including Boltzmann distribution/partition functions.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 521 Physical Chemistry I (3-4 credits)**

Covers thermodynamic principles and applications to gases, liquids, and ideal and non-ideal solutions; thermodynamics of chemical reactions and equilibria, electrochemistry and reaction kinetics.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 522 Physical Chemistry II (3-4 credits)**

Continuation of Physical Chemistry I, including quantum chemistry, reaction kinetics, spectroscopy, photochemistry, statistical mechanics, and theories of reaction rates.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 530 Instrumental Analysis (3 credits)**

This course covers the theory, methodology, and instrumentation for the study of atomic and molecular species and/or processes. Students who register for CHM 530 must also register for a CHM 530 laboratory. For example, if you register for CHM 530 you must, at the same time, register for a section of CHM 530L.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 530L Instrumental Analysis Lab (2 credits)**

This course covers the theory, methodology, and instrumentation for the study of atomic and molecular species and/or processes. Students who register for CHM 530 must also register for a CHM 530 laboratory. For example, if you register for CHM 530 you must, at the same time, register for a section of CHM 530L.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate



**CHM 560 Nanochemistry (3 credits)**

This course covers the synthesis, characterization and physical properties of materials chemistry systems on the length scale of individual molecules. Emphasis is placed on the distinction between macro- and nanoscale properties of matter. Course topics to include (but not limited to): quantum confinement in semiconductor nanocrystals; localized surface plasmon resonance (LSPR), superhydrophobicity in self-assembled monolayers; electronic and mechanical properties of 2D materials

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 570 Special Topics (3-4 credits)**

Topics will vary according to the semester in which the class is offered.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 610 Biophysical Chemistry (3 credits)**

This course utilizes the concepts of physical chemistry to understand the properties of biological systems.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 620 Atmospheric Environmental Chem (3 credits)**

This course examines the behavior of chemical species in the atmosphere. Topics include: stratospheric chemistry and the role of ozone, tropospheric chemistry and photochemical smog formation, precipitation, aerosol chemistry, indoor and urban air quality and regulatory efforts, energy, the chemistry of global climate and potential mitigation strategies, biogeochemical cycling of elements, and green chemistry.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 630 Mechanisms in Organic Chem (3 credits)**

Application of the electron pushing formalism for manipulating Lewis structure representations of organic structures. Emphasis is placed on mechanistic rationalization of complex organic transformations. Classes of mechanisms include elimination, substitution, rearrangement, oxidation-reduction, enolate alkylation, and others.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 640 Organometallics (3 credits)**

This course will focus on the structure and reactivity of organometallic transition metal complexes. Topics include catalysis, reaction mechanisms, applications to organic chemistry, and characterization by spectroscopic methods.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 642 Nucleic Acid Biochemistry (3 credits)**

Focused on molecular genetics. Topics include structure, replication, transcription, translation, repair, recombination, and processing of nucleic acids; control of gene expression; and modern recombinant methods of DNA splicing, cloning, and sequencing.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 660 Water Chemistry (3 credits)**

This course examines the behavior of chemical species in natural and engineered water systems and their interactions with the terrestrial environment. Topics include: the chemical composition of surface and subsurface water; geochemical controls on water composition; equilibrium and kinetic processes in aquatic systems; fate and reactions of inorganic and organic constituents in water; acid-base chemistry, complexation chemistry, and redox chemistry in water; the applications of isotopic and other tracers in the study of aquatic systems; water pollution and treatment.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 670 Special Topics (4 credits)**

Topics will vary according to the semester in which the class is offered.

*Attributes:* Graduate

**CHM 680 Inorganic Biochemistry (3 credits)**

The chemical and biological properties of various metal ions in biological systems will be examined at the molecular level. Permission of the Department of Chemistry chair is required.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 690 Spectroscopy (3 credits)**

This course provides an exposure to aspects of spectroscopic theory, methods, and instrumentation that are not covered in Instrumental Analysis.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 700 Intro to Graduate Studies (1-3 credits)**

Individualized coursework designed to strengthen a student's background prior to taking advanced graduate courses.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 711 Medicinal Chemistry (3 credits)**

A study of the biochemical mechanisms of drug action in order to develop a rational approach to the analysis of drugs and their metabolites and to design new drugs.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 714 Structure-Activity Relationships (3 credits)**

Selected classes of medicinal agents are examined, stressing general structures, synthesis, and, in particular, the relationships between structure and pharmacological activity.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 716 Chemical Synthesis Laboratory (3 credits)**

Techniques of organic and inorganic synthesis, including reaction control, vacuum and fractional distillation, uniform reagent addition, controlled stirring, operation in inert atmosphere, safe handling of toxic or unstable reagents, and chromatographic purification.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 718 Heterocyclic Chemistry (3 credits)**

A study of the major types of aromatic and nonaromatic heterocyclic compounds with a special interest in those having biochemical activity: their synthesis, physical properties, reactivity, and influence on living systems, etc.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.

*Attributes:* Doctoral, Graduate

**CHM 720 Apps of Computational Chem (3 credits)**

Introduction to the theory and applications of computational chemistry methods, including quantum mechanics, density functional theory, and classical molecular dynamics simulation methods. Project-based exercises on applying the above methods to chemical/biochemical processes while utilizing state-of-the-art computational software packages.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.  
*Attributes:* Doctoral, Graduate

**CHM 721 Chemical Kinetics (3 credits)**

The study of theoretical aspects of reaction kinetics and the experimental methods used to measure the rates of reactions.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.  
*Attributes:* Doctoral, Graduate

**CHM 728 Advanced Biochemistry (3 credits)**

Selected topics in protein structure and function, especially enzymology.

*Restrictions:* Enrollment is limited to Graduate level students.

**CHM 733 Computational Chemistry (3 credits)**

This course will give hands on training in current computational chemistry methods. Particularly on how to manipulate large data sets through computational algorithms and programs. The course will explore and have hands on training with practical computational methods currently used in modern computational research.

*Restrictions:* Enrollment is limited to Graduate level students.  
*Attributes:* Graduate

**CHM 748 Computer Aided Drug Design (3 credits)**

Introduction to the theory and practice of molecular modeling, especially as applied to the problem of identifying and designing bioactive and therapeutic agents, using specialized software and advanced computer hardware such as workstations and supercomputer clusters.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.  
*Attributes:* Doctoral, Graduate

**CHM 786 Research Ethics (1 credit)**

This course will provide an examination of ethical behavior and practice in scientific research. The course will follow a case study format in which students will be expected to present and participate in group discussions.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.  
*Attributes:* Doctoral, Graduate

**CHM 802 Research Seminar (2 credits)**

Students present a formal seminar based on their research endeavors.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.  
*Attributes:* Doctoral, Graduate

**CHM 815 Intro to Polymer Chemistry (3 credits)**

This course will cover basic concepts and the most important topics in modern polymer science including synthesis, physical properties, and current applications.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.  
*Attributes:* Doctoral, Graduate

**CHM 878 Introduction to Research (1 credit)**

A laboratory rotation through two seven-week chemical, biochemical, or pharmacognosy research projects for graduate students matriculated in a graduate program in the Department of Chemistry & Biochemistry.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.  
*Attributes:* Doctoral, Graduate

**CHM 887 Graduate Colloquium (1 credit)**

This course will highlight and help students develop the skills needed to be successful graduate school. We will discuss many components of the graduate school, such as (but not limited to) reading and critiquing papers, writing papers and grants, getting along with lab mates, and being an effective instructor. We will go over some strategies for life balance which will include having fun and learning during this process.

This course will help you prepare you for the next step(s) in your career.  
*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.  
*Attributes:* Doctoral, Graduate

**CHM 892 Non-trivial Problems in Chem (3 credits)**

This course will discuss the practical aspects of solving everyday problems encountered in research in the physical and natural sciences. Students will apply knowledge from different fields of chemistry and various other scientific disciplines to solve chemical problems. Students will also learn the application of mathematical modeling and numerical fitting to quantitatively determine solutions to these problems.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.  
*Attributes:* Doctoral, Graduate

**CHM 897 Scientific Proposals (3 credits)**

This course is designed to guide students in the development of an F31 - Kirschstein NRSA grant application. The course is heavily weighted in writing and peer assessment of grant proposals. By the end of the course, students will be expected to have completed the Specific Aims page and Research Plan sections of the F31 application. For thesis students, the application must be focused on the student's approved research prospectus and build upon current research in the student's thesis laboratory. Student's without an approved research prospectus, part-time extramural thesis students and non-thesis graduate students will develop a grant application focused on a research project of interest.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.  
*Attributes:* Doctoral, Graduate

**CHM 899 Graduate Research (1-9 credits)**

Candidates for the Doctor of Philosophy degree, specializing in chemistry, biochemistry, or pharmacognosy, are required to fulfill their research requirement under the direction of a faculty member in the department graduate program.

*Restrictions:* Enrollment is limited to Doctoral or Graduate level students.  
*Attributes:* Doctoral, Graduate