

# CHEMISTRY (CHE)

## **CHE 102 | MOLECULES THAT SHAPED THE WORLD | 4 quarter hours (Undergraduate)**

A course for non-science majors that presents how molecules and basic chemical concepts have shaped our world. Introductory concepts in chemistry, focusing on atomic and molecular structure and reactivity, will be placed in the larger context of the development of modern human civilization and culture. Topics of discussion may include the roles molecules have played in shaping: cuisine, energy, health, medicine, fashion, environmental policy, and others.

## **CHE 103 | ENVIRONMENTAL CHEMISTRY | 4 quarter hours (Undergraduate)**

A discussion and laboratory exploration of the technological origins, effects, and control of environmental pollutants.

## **CHE 104 | CHEMICALS, DRUGS AND LIVING SYSTEMS | 4 quarter hours (Undergraduate)**

A discussion of the molecular basis of the interaction of specific chemical compounds (chiefly pharmaceuticals and drugs) with living organisms.

## **CHE 105 | EXPLORING NUTRIENTS/SCIENCE OF NUTRITION | 4 quarter hours (Undergraduate)**

A discussion and laboratory exploration of the chemical molecules which supply nutrients for living organisms. This course also includes a quantitative project, applicable to the individual student, to enhance the understanding of the principles of nutrition.

## **CHE 106 | GEOCHEMISTRY | 4 quarter hours (Undergraduate)**

This course for non-science majors that introduces students to basic chemical and geological concepts through a discussion of the chemical principles and scientific laws governing the composition and chemical transformation of the components making up the Earth. Major topics include the scientific method, reporting and treatment of quantitative data, introduction to the basic principles of matter, chemical reactivity, and radioactive decay.

## **CHE 109 | FORENSIC CHEMISTRY | 4 quarter hours (Undergraduate)**

Discussion and laboratory exploration of the application of modern science to problems in criminology, evidence, art, and archaeology.

## **CHE 116 | GENERAL, ORGANIC AND BIOLOGICAL CHEMISTRY I | 3 quarter hours (Undergraduate)**

First course of a two-quarter sequence designed to introduce the physical and chemical properties of molecules. This course will cover: atomic and molecular structure, the states of matter, description of gases, preparation of solutions, acid/base chemistry, reactions and equilibrium and introduction to structure and conventional drawing of organic molecules.

**CHE 117 is a co-requisite for this class.**

## **CHE 117 | GENERAL, ORGANIC AND BIOLOGICAL CHEMISTRY LABORATORY I | 1 quarter hour (Undergraduate)**

This laboratory course introduces students to basic chemical laboratory techniques, while providing hands-on experience and applications related to CHE 116 course material.

**CHE 116 is a co-requisite for this class.**

## **CHE 118 | GENERAL, ORGANIC AND BIOLOGICAL CHEMISTRY II | 3 quarter hours**

**(Undergraduate)**

Second course of a two-quarter sequence designed to introduce the physical and chemical properties of molecules. This course will cover: basic reactivity of organic functional groups relevant to biological systems, description of biomolecules (proteins, carbohydrates, nucleic acids and lipids), enzyme and vitamin chemistry, nucleic acid and protein synthesis and metabolic pathways and energy production.

**C- or better in CHE 116 and CHE 117 are prerequisites for this class.**

**CHE 118 is a co-requisite for this class.**

## **CHE 119 | GENERAL, ORGANIC AND BIOLOGICAL CHEMISTRY LABORATORY II | 1 quarter hour**

**(Undergraduate)**

This laboratory course continues to practice basic laboratory skills learned in CHE 117, while introducing new organic and biochemical techniques related to CHE 118 course material.

**C- or better in CHE 116 and CHE 117 are prerequisites for this class.**

**CHE 118 is a co-requisite for this class.**

## **CHE 120 | GENERAL CHEMISTRY IP | 5 quarter hours (Undergraduate)**

This introductory course for science majors covers the same subject matter and sequence of topics as that of CHE 130, however this course includes additional coverage of fundamental chemistry concepts and more in-class time devoted to developing problem-solving skills. CO-REQUISITE(S): CHE131 and MAT 130 if math placement indicates MAT 130 (5 quarter hours)

**Placement by the Chemistry Placement Test is a prerequisite for this class. CHE 131 is a co-requisite for this class. MAT 130 is a prerequisite for this class (determined by Math placement test score).**

## **CHE 122 | GENERAL CHEMISTRY IIP | 5 quarter hours (Undergraduate)**

Second course of three in the General Chemistry series that covers the same material as that of CHE 132, however this course includes additional coverage of fundamental chemistry concepts and more in-class time devoted to developing problem-solving skills. CO-REQUISITE(S): CHE133 (5 quarter hours)

**A grade of C- or better in (CHE 120 or CHE 130) and in CHE 131 are prerequisites for this class. CHE 133 is a co-requisite for this class.**

## **CHE 128 | BASIC CHEMICAL CONCEPTS | 3 quarter hours (Undergraduate)**

This course develops the fundamental concepts of chemistry and basic quantitative reasoning. This course is suitable to prepare students to take General Chemistry I (CHE130 or CHE 136). (3 quarter hours)

**CHE 129 and MAT 130 or higher are a corequisite for this class.**

## **CHE 129 | BASIC CHEMICAL CONCEPTS LABORATORY | 1 quarter hour (Undergraduate)**

Laboratory course to be taken in conjunction with CHE128. (1 quarter hour)

**CHE 128 and MAT 130 or higher are a corequisite for this class**

## **CHE 130 | GENERAL CHEMISTRY I | 3 quarter hours (Undergraduate)**

This introductory course for science majors emphasizes the composition of matter, atomic and molecular structure, bonding and chemical reactions. It is the first in the three-course sequence of General Chemistry. CO-REQUISITE(S): CHE131 (3 quarter hours)

**MAT 130 is a pre-requisite for this class. CHE 131 is a co-requisite for this class.**

**CHE 131 | GENERAL CHEMISTRY I LABORATORY | 1 quarter hour (Undergraduate)**

Laboratory course to be taken in conjunction with CHE 120 or CHE 130. The experimental techniques provide hands-on experience with the course material in CHE 120 and CHE 130. CO-REQUISITE(S): CHE 120 or CHE 130 (1 quarter hour)

**Either CHE 120 or CHE 130 is a co-requisite for this class.**

**CHE 132 | GENERAL CHEMISTRY II | 3 quarter hours (Undergraduate)**

Second course of three in the General Chemistry series. Topics discussed include: states of matter, phase transitions, properties of solutions, kinetics and equilibrium. CO-REQUISITE(S): CHE 133 (3 quarter hours)

**A grade of C- or above in CHE 131 and (CHE 122 or CHE 120 or CHE 130) are prerequisites for this class. CHE 133 is a co-requisite for this class.**

**CHE 133 | GENERAL CHEMISTRY LABORATORY II | 1 quarter hour (Undergraduate)**

Laboratory course to be taken in conjunction with CHE 122 or CHE 132. The experimental techniques learned in lab provide hands-on experience with the course material in CHE 122 and CHE 132. CO-REQUISITE(S): CHE 122 or CHE 132 (1 quarter hour)

**A minimum grade of C- in (CHE 120 or CHE 130) and in CHE 131 are prerequisites for this class. CHE 122 or CHE 132 is a corequisite for this class.**

**CHE 134 | GENERAL CHEMISTRY III | 3 quarter hours (Undergraduate)**

Third of three courses in the General Chemistry sequence. Topics discussed include: chemical equilibrium in aqueous solution (acids and bases, solubility, complex ion formation), thermodynamics (entropy and free energy), electrochemistry, chemistry of d-block elements and descriptive chemistry. CO-REQUISITE(S): CHE 135 (3 quarter hours)

**A minimum grade of C- in (CHE 122 or CHE 132) and in CHE 133 are prerequisites for this class and CHE 135 is a corequisite for this class.**

**CHE 135 | GENERAL CHEMISTRY LABORATORY III | 1 quarter hour (Undergraduate)**

Laboratory course to be taken in conjunction with CHE 134. The experimental techniques provide hands-on experience with the course material in CHE 134. CO-REQUISITE(S): CHE 134 (1 quarter hour)

**A minimum grade of C- in (CHE 122 or CHE 132) and in CHE 133 are prerequisites for this class and CHE 134 is a corequisite for this class.**

**CHE 136 | GENERAL CHEMISTRY I | 5 quarter hours (Undergraduate)**

This course is a rigorous introductory course in general chemistry covering topics such as composition of matter, atomic and molecular structure, bonding and chemical reactions, common states of matter, properties of solutions, phase transitions. Students must coregister for CHE 137, the laboratory course. (5 quarter hours)

**MAT 130 or equivalents or placement by test is a prerequisite for this class.**

**CHE 137 | GENERAL CHEMISTRY I LABORATORY | 1 quarter hour (Undergraduate)**

Laboratory course to be taken in conjunction with CHE 136. This laboratory course introduces students to basic chemical laboratory techniques. (1 quarter hour)

**MAT 130 or equivalents or placement by test is a prerequisite for this class.**

**CHE 138 | GENERAL CHEMISTRY II | 5 quarter hours (Undergraduate)**

This course is a continuation of CHE136 covering topics including kinetics, chemical equilibrium in aqueous solution (acids and bases, solubility, complex ion formation), thermodynamics (entropy and free energy), electrochemistry, chemistry of d-block elements and descriptive chemistry. Students must coregister for CHE 139, the laboratory course. (5 quarter hours)

**A minimum grade of C- in CHE 136 and CHE 137 is a prerequisite for this class.**

**CHE 139 | GENERAL CHEMISTRY II LABORATORY | 1 quarter hour (Undergraduate)**

This laboratory course is a continuation of CHE137, emphasizing additional quantitative and qualitative laboratory techniques to coincide with CHE138 content. (1 quarter hour)

**A minimum grade of C- in CHE 136 and CHE 137 is a prerequisite for this class.**

**CHE 204 | ANALYTICAL CHEMISTRY | 3 quarter hours (Undergraduate)**

Use of equilibrium chemistry to solve problems of chemical analysis in acid-base, solubility, metal-ligand complex, and electrochemical systems. CO-REQUISITE: CHE 205. (3 quarter hours)

**A grade of C- or better in (CHE 134 and CHE 135) or (CHE 138 and CHE 139) or (CHE 144 and 145) is a prerequisite for this class. CHE 205 is a co-requisite.**

**CHE 205 | ANALYTICAL CHEMISTRY LABORATORY | 1 quarter hour (Undergraduate)**

Laboratory to be taken in conjunction with CHE 204. Methods include wet chemistry and instrumental techniques of analysis. CO-REQUISITE(S): CHE 204. (1 quarter hour)

**A grade of C- or better in (CHE 134 and CHE 135) or (CHE 138 and CHE 139) or (CHE 144 and CHE 145) is a prerequisite for this class. CHE 204 is a co-requisite.**

**CHE 228 | SURVEY OF ORGANIC CHEMISTRY | 3 quarter hours (Undergraduate)**

This one-quarter course gives students an overview of the fundamentals of organic chemistry and its applications in health and environmental sciences. This is a survey course meant for students who do not need to learn a full year of organic chemistry. Emphasis is on the structure, function, and reactivity of the major classes of organic compounds. This course meets for six hours per week: three hours of traditional lecture and three hours of lab. The course is suitable for nursing and environmental science students; it does not substitute for any traditional organic chemistry course. CO-REQUISITE(S): CHE 229. (3 quarter hours)

**A grade of C- or better in (CHE 132 and CHE 133) or (CHE 138 and CHE 139) is a prerequisite for this class.**

**CHE 229 | SURVEY OF ORGANIC CHEMISTRY LABORATORY | 1 quarter hour (Undergraduate)**

Laboratory to be taken in conjunction with CHE 229. CO-REQUISITE(S): CHE 228. (1 quarter hour)

**A grade of C- or better in (CHE 132 and CHE 133) or (CHE 138 and CHE 139) is a prerequisite for this class.**

**CHE 230 | ORGANIC CHEMISTRY I | 3 quarter hours  
(Undergraduate)**

First in a sequence of courses designed to investigate what organic chemistry is and how it works, by emphasizing the relationship between structure and function of organic molecule and the language and fundamental concepts of organic chemistry, including: structure and bonding; acid-base reactions; functional groups; thermodynamics and kinetics of organic reactions; stereochemistry; substitution and elimination reactions of alkyl halides. (3 quarter hours)

**A minimum grade of C- in ([CHE 134 and CHE 135] or [CHE 138 and CHE 139] or [CHE 144 and CHE 145]) and CHE 231 as a corequisite is a required for this class.**

**CHE 231 | ORGANIC CHEMISTRY LABORATORY I | 1 quarter hour  
(Undergraduate)**

Laboratory to be taken in conjunction with CHE 230. (1 quarter hour)

**A minimum grade of C- in ([CHE 134 and CHE 135] or [CHE 138 and CHE 139] or [CHE 144 and CHE 145]) is a prerequisite for this class. CHE 230 is a corequisite for this class.**

**CHE 232 | ORGANIC CHEMISTRY II | 3 quarter hours  
(Undergraduate)**

Second in a sequence of courses designed to investigate what organic chemistry is and how it works, by emphasizing the relationship between structure and function of organic molecules. Specific topics investigated include the reactivity and synthesis of alcohols, ethers, epoxides, alkenes, alkynes, alkanes, conjugated, and aromatic compounds. To be taken in conjunction with CHE 233. (3 quarter hours)

**A minimum grade of C- in CHE 230 and CHE 231 is a prerequisite for this class. CHE 233 is a corequisite for this class.**

**CHE 233 | ORGANIC CHEMISTRY LABORATORY II | 1 quarter hour  
(Undergraduate)**

Laboratory to be taken in conjunction with CHE 232. (1 quarter hour)

**A minimum grade of C- in CHE 230 and CHE 231 is a prerequisite for this class. CHE 232 is a corequisite for this class.**

**CHE 234 | ORGANIC CHEMISTRY III | 3 quarter hours  
(Undergraduate)**

Third in a sequence of courses designed to investigate what organic chemistry is and how it works, by emphasizing the relationship between structure and function of organic molecules. Specific topics investigated include the reactivity and synthesis of carbonyl compounds; amines; and bio-molecules. To be taken in conjunction with CHE 235. (3 quarter hours)

**A minimum grade of C- in CHE 232 and CHE 233 is a prerequisite for this class. CHE 235 is a corequisite for this class.**

**CHE 235 | ORGANIC CHEMISTRY LABORATORY III | 1 quarter hour  
(Undergraduate)**

Laboratory to be taken in conjunction with CHE 234. (1 quarter hour)

**A minimum grade of C- in CHE 232 and CHE 233 is a prerequisite for this class.**

**CHE 236 | ORGANIC CHEMISTRY I | 5 quarter hours  
(Undergraduate)**

First in a sequence of courses designed to investigate what organic chemistry is and how it works, by emphasizing the relationship between structure and function of organic molecules, and the language and fundamental concepts of organic chemistry. Specific topics that are covered include the following: structure and bonding; acids and bases; functional groups; thermodynamics and kinetics of organic reactions; alkanes; stereochemistry; alkyl halides and nucleophilic substitution; elimination reactions; alcohols, ethers and epoxides; alkenes; alkynes; oxidation and reduction. CO-REQUISITE(S): CHE 237. (5 quarter hours)  
**C- or better in (CHE 134 and CHE 135) or (CHE 138 and CHE 139) are a prerequisite for this class.**

**CHE 237 | ORGANIC CHEMISTRY I LABORATORY | 1 quarter hour  
(Undergraduate)**

Laboratory to be taken in conjunction with CHE 236. CO-REQUISITE(S): CHE 236. (1 quarter hour)

**C- or better in (CHE 134 and CHE 135) or (CHE 138 and CHE 139) are a prerequisite and CHE 236 is a corequisite for this class**

**CHE 238 | ORGANIC CHEMISTRY II | 5 quarter hours  
(Undergraduate)**

Second in a sequence of courses designed to investigate what organic chemistry is and how it works, by emphasizing the relationship between structure and function of organic molecules, and the language and fundamental concepts of organic chemistry. Specific topics that are covered include the following: conjugation, resonance, and dienes; benzene and aromatic compounds; electrophilic aromatic substitution; carboxylic acids; organometallic reagents; carbonyl substitution and addition reactions; aldehydes and ketones; carbonyl condensation reactions; amines; bio-molecules. To be taken in conjunction with CHE 239. (5 quarter hours)

**A minimum grade of C- in CHE 236 and CHE 237 is a prerequisite for this course.**

**CHE 239 | ORGANIC CHEMISTRY II LABORATORY | 1 quarter hour  
(Undergraduate)**

Laboratory to be taken in conjunction with CHE 238. (1 quarter hour)

**A minimum grade of C- in CHE 236 and CHE 237 is a prerequisite for this course.**

**CHE 261 | INSTRUMENTAL ANALYSIS | 4 quarter hours  
(Undergraduate)**

A lecture and lab course examining instrumentation in chemical analysis. Areas of focus include electronics and measurement theory, applied measurement statistics, chromatography, spectroscopy, and electroanalytical instruments and their applications.

**Grades of C- or better in both CHE 204 and CHE 205 are prerequisites for this class.**

**CHE 264 | ATMOSPHERIC CHEMISTRY | 3 quarter hours  
(Undergraduate)**

Atmospheric chemistry with a focus on physical and chemical processes in the troposphere and stratosphere. CO-REQUISITE(S):CHE 265. (3 quarter hours)

**C- or better in CHE 204 and CHE 205 are prerequisites for this course.**

**CHE 265 | ATMOSPHERIC CHEMISTRY LABORATORY | 1 quarter hour  
(Undergraduate)**

Laboratory to be taken in conjunction with CHE 264, with emphasis placed on gas phase and particulate measurements. CO-REQUISITE(S): CHE 264. (1 quarter hour)

**C- or better in CHE 204 and CHE 205 are a prerequisite for this class.**

**CHE 300 | THERMODYNAMICS AND INTRODUCTION TO QUANTUM MECHANICS | 4 quarter hours****(Undergraduate)**

This course will cover topics in thermodynamics, including thermodynamic laws, chemical potential, and both phase and chemical equilibria. In addition, the postulates of quantum mechanics will be discussed, and these postulates will be applied to simple systems, allowing spectroscopic applications to be explored.

**C- or better in (CHE 134 and CHE 135) or (CHE 138 and CHE 139) and (C- or better in MAT 149 or MAT 152 or MAT 162 or MAT 172 or MAT 156) and (C- or better in PHY 152 or PHY 172 or PHY 156) are pre-requisites for this class.**

**CHE 302 | QUANTUM CHEMISTRY | 3-4 quarter hours****(Undergraduate)**

This is the first course in a three-quarter long physical chemistry sequence. This course focuses on quantum mechanics: a theoretical description of matter at the microscopic level. The energy levels of atoms and molecules will be derived; spectroscopic applications will be explored. Students must co-register for the laboratory companion course, CHE 303. (3 quarter hours)

**D or better in CHE 300 is a pre-requisite for this class.**

**CHE 303 | EXPERIMENTAL PHYSICAL CHEMISTRY I | 1 quarter hour****(Undergraduate)**

Laboratory to be taken in conjunction with CHE 302 when 302 is taught as a 3-credit hour course. Introduction to essential skills and techniques of experimental physical chemistry. Topics include the use of data analysis software, computational methods, basic spectroscopy, and technical writing. CO-REQUISITE(S): CHE 302. (1 quarter hour)

**(C- or better in CHE 204 and CHE 205) and (MAT 149 or MAT 152 or MAT 162 or MAT 172) and PHY 172 are prerequisites for this course.**

**CHE 304 | THERMOCHEMISTRY | 3 quarter hours****(Undergraduate)**

This is the second course in a three-quarter long physical chemistry sequence. This course explores the molecular-scale effects of quantum mechanics and thermodynamics. The understanding of quantum mechanics gained during CHE 302 is extended into the molecular regime, with a focus on bonding. The basic principles of thermodynamics are explored in detail. These principles are then applied to build up a detailed understanding of chemical equilibria and the properties of various states of matter. Students must co-register for the laboratory companion course, CHE 305. (3 quarter hours)

**C- or better in CHE 302 and CHE 303 are a prerequisite for this class.**

**CHE 305 | EXPERIMENTAL PHYSICAL CHEMISTRY II | 1 quarter hour****(Undergraduate)**

Laboratory to be taken in conjunction with CHE 304. The goal of this laboratory course is to teach students essential skills and techniques of physical chemistry. Experimental work will focus on electronic spectroscopy and thermodynamics. CO-REQUISITE(S): CHE 304. (1 quarter hour)

**C- or better in CHE 302 and CHE 303 are a prerequisite for this class.**

**CHE 306 | KINETICS AND STATISTICAL THERMODYNAMICS | 3-4 quarter hours****(Undergraduate)**

This is the third course in a three-quarter long physical chemistry sequence. This course focuses on the connection between quantum mechanics and thermodynamics, as well as chemical kinetics. Topics discussed may include: kinetics, molecular dynamics, statistical mechanics, and transport properties.

**C- or better in CHE 302 is a pre-requisite for this class.**

**CHE 307 | EXPERIMENTAL PHYSICAL CHEMISTRY III | 1 quarter hour****(Undergraduate)**

Laboratory to be taken in conjunction with CHE 306. The goal of this laboratory course is to teach students essential skills and techniques of physical chemistry. CO-REQUISITE(S): CHE 306. (1 quarter hour)

**C- or better in CHE 304 and CHE 305 are prerequisites for this course.**

**CHE 310 | NUCLEAR CHEMISTRY | 4 quarter hours****(Undergraduate)**

This is a course for advanced undergraduates and graduate students. The course emphasizes the theory of radioactive decay, nuclear properties, mass-energy systematics, and nuclear applications.

**(C- or better in CHE 205) and (PHY 152 or PHY 172) are prerequisites for this course.**

**CHE 315 | PHYSICAL CHEMISTRY LAB | 4 quarter hours****(Undergraduate)**

This four-credit laboratory course will include experiments related to thermodynamics, quantum mechanics, and kinetics. Experiments in computational chemistry may also be included. Students will be introduced to advanced software used for data analysis.

**C- or better in (CHE 204 and CHE 205) and CHE 300 required.**

**CHE 318 | BIOPHYSICAL CHEMISTRY | 4 quarter hours****(Undergraduate)**

This course is designed for advanced undergraduate students with an interest in the interdisciplinary field of biophysics. The course will focus on several subfields of biophysical chemistry, including: fluorescence as a tool in biophysics; protein folding; biophysical applications of single molecule fluorescence, atomic force microscopy, X-ray crystallography, mass spectrometry, and NMR spectroscopy. Additional topics will be selected by students from a list of possible choices.

**C- or better in CHE 300 or CHE 302 or CHE 308 or CHE 340 is a pre-requisite for this class.**

**CHE 320 | INTERMEDIATE INORGANIC CHEMISTRY | 3 quarter hours****(Undergraduate)**

Lecture course emphasizing synthesis, structure and reactions of metal ligand compounds of general and biological interest. CO-REQUISITE(S): CHE 321. (3 quarter hours)

**C- or better in (CHE 234 and CHE 235) or (CHE 238 and CHE 239) are a prerequisite for this class.**

**CHE 321 | INTERMEDIATE INORGANIC CHEMISTRY LABORATORY | 1 quarter hour****(Undergraduate)**

Laboratory to be taken in conjunction with CHE 320. CO-REQUISITE(S): CHE 320. (1 quarter hour)

**C- or better in (CHE 234 and CHE 235) or (CHE 238 and CHE 239) are a prerequisite for this class.**

**CHE 326 | ORGANOMETALLIC CHEMISTRY | 3 quarter hours  
(Undergraduate)**

Organometallic chemistry is the study of compounds that contain a metal-carbon bond, and thus unites the fields of organic and inorganic chemistry. Organometallic compounds are commonly employed throughout various chemical sub-industries for the synthesis of pharmaceuticals, liquid crystals, polymer precursors, fragrances, hormones and more. This course will provide an introduction to the fundamental structure and bonding of organometallic complexes, while offering an in depth study of the unique reaction mechanisms by which metals, particularly transition metals, react with organic molecules. Applications of these compounds and reactions to real-world industrial processes will also be presented to highlight the tremendous utility of this chemistry. Students must co-register for the laboratory companion course, CHE 327. (3 quarter hours)

**C- or better in (CHE234 and CHE235) or (CHE238 and CHE239) are prerequisites for this course.**

**CHE 327 | ORGANOMETALLIC CHEMISTRY LABORATORY | 1 quarter hour  
(Undergraduate)**

Laboratory to be taken in conjunction with CHE 326. This course is designed to provide the student with a thorough introduction to the experimental techniques utilized by practicing chemists in the synthesis, isolation, and characterization of organic compounds. CO-REQUISITE(S): CHE 326. (1 quarter hour)

**C- or better in (CHE234 and CHE235) or (CHE238 and CHE239) are prerequisites for this course.**

**CHE 330 | SENIOR CAPSTONE IN THE PHYSICAL SCIENCES | 4 quarter hours  
(Undergraduate)**

Capstone in the Physical Sciences. A course for graduating chemistry and physics majors to integrate physical science experience with non-scientific fields.

**CHE 332 | POLYMER SCIENCE | 3 quarter hours  
(Undergraduate)**

This course has been designed to expose students to various aspects of polymer science. The course will focus on the synthesis, structure, and properties of an array of both synthetic and natural polymers. Students will learn the means by which various classes of polymers are prepared and characterized, with an emphasis on the mechanisms of formation, including: free radical, cationic, anionic, condensation, and transition metal-mediated and catalyzed polymerization methods. The course will also highlight differences in the physical properties of polymers, and how such differences can be controlled and exploited for practical purposes. Students will also be introduced to more modern macromolecular materials including dendrimers and nanostructures. The applications of the polymers discussed in the course will also be presented in order to provide context for the real-world utility of these materials. Students must register for the co-requisite laboratory companion course, CHE 333.

**C- or better in (CHE 234 and CHE 235) or (CHE 238 and CHE 239) are prerequisites for this course and CHE 333 is a co-requisite for this class.**

**CHE 333 | POLYMER SCIENCE LAB | 1 quarter hour  
(Undergraduate)**

Laboratory to be taken in conjunction with CHE 332. This course is designed to provide students with practical skills in the area of polymer science. The course will cover topics related to the synthesis, isolation, and characterization of polymeric materials. Students must be co-registered for the lecture course CHE 332.

**C- or better in (CHE 234 and CHE 235) or (CHE 238 and CHE 239) are prerequisites for this course and CHE 332 is a co-requisite for this class.**

**CHE 334 | NANOMATERIALS AND NANOTECHNOLOGY | 4 quarter hours  
(Undergraduate)**

Nanotechnology is a well-established sector of our technology economy, driving much of the function of modern electronics. Nanomaterials and nanotechnology are also thriving research fields, both in industry and academia. This course will prepare students to work in this exciting and growing field. In the first section of the course we will explore what it means for something to be a nanomaterial, and how the properties of nanomaterials can be determined. In the second section of the course we will explore several nanotechnologies, identifying the mechanisms that facilitate the special functions of the nanomaterials used to produce them. Students will also get hands-on experience creating nanomaterials in a laboratory.

**A minimum grade of C- in ([CHE 134 and CHE 135] or [CHE 138 and CHE 139] or [CHE 144 and CHE 145]) and CHE 231 as a corequisite is a required for this class.**

**CHE 340 | BIOCHEMISTRY I | 3 quarter hours  
(Undergraduate)**

First in a two-course sequence, directed at those who wish an in-depth exploration of modern biochemistry. This course covers the structures and functions of the four major macromolecules, concentrating on enzyme kinetics and regulation. CO-REQUISITE(S): CHE 341. The general biology sequence is strongly recommended. (3 quarter hours)

**A grade of C- or better in (CHE234 and CHE 235) or (CHE 238 and CHE 239) is a prerequisite for this course.**

**CHE 341 | EXPERIMENTAL BIOCHEMISTRY I | 1 quarter hour  
(Undergraduate)**

Laboratory to be taken in conjunction with CHE 340. This course will introduce classic and modern techniques for isolating and characterizing biological molecules. Topics covered include buffer preparation; protein extraction and quantification; enzyme kinetics; purification and analysis of DNA; protein stabilization; and molecular interaction analysis. CO-REQUISITE(S): CHE 340. (1 quarter hour)

**A grade of C- or better in (CHE234 and CHE 235) or (CHE 238 and CHE 239) is a prerequisite for this course.**

**CHE 342 | BIOCHEMISTRY II | 3 quarter hours  
(Undergraduate)**

Second in a two-course sequence, directed at those who wish an in-depth exploration of modern biochemistry. This course covers signaling and bioenergetics with emphasis on the biosynthetic pathways of carbohydrate, protein, and fatty acid catabolism and their coordinated regulation. CO-REQUISITE(S): CHE 343. (3 quarter hours)

**C- or better in CHE 340 and CHE 341 are a prerequisite for this class.**

**CHE 343 | EXPERIMENTAL BIOCHEMISTRY II | 1 quarter hour  
(Undergraduate)**

Laboratory to be taken in conjunction with CHE 342. The experimental techniques of this course provide hands-on experience with systems, techniques, and technologies covered in CHE 342. Topics include lipid extraction, separation, and analysis; use of computational tools; enzyme purification and analysis; ELISA analysis of hormones; DNA amplification; and recombinant DNA technology. CO-REQUISITE(S): CHE 342. (1 quarter hour)

**C- or better in CHE 340 and CHE 341 are a prerequisite for this class.**

**CHE 344 | BIOCHEMISTRY III | 3-4 quarter hours  
(Undergraduate)**

This course is an in-depth exploration of modern biochemistry beyond the two-course sequence. It covers hormonal regulation of metabolism; anabolic metabolism of amino acids, lipids, and nucleic acids; nucleic acid replication, transcription, and protein translation; gene regulation; and an overview of the methods of biotechnology. Students will also be introduced to reading primary literature.

**C- or better in CHE 342 is a pre-requisite for this class.**

**CHE 345 | EXPERIMENTAL BIOCHEMISTRY III | 1 quarter hour  
(Undergraduate)**

Laboratory to be taken in conjunction with CHE 344. This course will introduce students to special topics laboratory techniques and bioinformatics methods including protein function prediction and structure analysis and DNA/protein sequence analysis and alignment. CO-REQUISITE(S): CHE 344. (1 quarter hour)

**C- or better in CHE 342 and CHE 343 are a prerequisite for this class.**

**CHE 346 | PRINCIPLES OF BIOCHEMISTRY | 4 quarter hours  
(Undergraduate)**

This course covers the key topics in biochemistry. These include non-covalent interactions, acid/base chemistry, chemical and three-dimensional structures of proteins/nucleic acids/lipids, hemoglobin oxygen binding, cytoskeletal and motor proteins, enzyme mechanisms/kinetics, membrane and membrane proteins/transport, signaling, energy metabolism and biosynthesis. Formerly CHE 240. This course is not intended for students majoring in chemistry and does not count as a CHE 250+ in-depth course for the major.

**C- or better in CHE 232 or CHE 238 is a prerequisite for this class.**

**CHE 348 | CHEMICAL BIOLOGY | 4 quarter hours  
(Undergraduate)**

This course introduces students to a new discipline spanning the fields of chemistry and biology in which chemical techniques and tools, often compounds produced through synthetic chemistry are used to study and manipulate biological systems in an effort to unravel biological problems and systems. The course will take a case study approach. Techniques encountered in the case study will be studied in depth. Primary literature will be used extensively in the in depth case study.

**C- or better in CHE 340 is a prerequisite for this class.**

**CHE 360 | MEDICINAL CHEMISTRY | 4 quarter hours  
(Undergraduate)**

This course emphasizes organic chemical principles and reactions vital to drug design and drug action in the human body. Medicinal chemists design molecules that alter phenomena operating at the overlap of chemistry, biochemistry, cell biology, and pharmacology. This course introduces the conceptual frameworks and methods employed in drug development using case histories and mechanisms of clinically important drugs as illustrative examples.

**C- or better in CHE 234 or CHE238 are prerequisites for this course.**

**CHE 362 | DRUGS AND TOXICOLOGY | 4 quarter hours  
(Undergraduate)**

This course covers the chemical and biological analysis of the metabolism and distribution of drugs, toxins and chemicals in animals and humans, and the mechanism by which they cause therapeutic and toxic responses. Metabolism and toxicity as a basis for drug development, metabolic polymorphisms and biomarkers of exposure are also covered.

**C- or better in CHE 234 or CHE 238 is a prerequisite for this class.**

**CHE 364 | NUTRITION | 4 quarter hours  
(Undergraduate)**

This course focuses on the advanced biochemical aspects of human nutrition and physiological function. The proposed topics of discussion include the structure, function and metabolism of all macronutrients (carbohydrates, proteins and lipids). We will also cover the interrelationship among these metabolic pathways and the impact on physical exertion and energy expenditure. The material will be covered through lectures, online quizzes, homework assignments, manuscript discussions and oral presentations.

**C- or better in CHE 234 or CHE 238 and CHE 340 are a prerequisite for this class.**

**CHE 376 | COMPUTATIONAL CHEMISTRY | 4 quarter hours  
(Undergraduate)**

This course is designed to provide an accessible and practical introduction to computational chemistry. The course provides an overview of different methods commonly used in the field ranging from classical to quantum mechanical ab initio and density functional methods. PREREQUISITE(S): CHE302.

**A grade of C- or better in (PHY 152 or PHY 172) and CHE 234 are prerequisites for this class.**

**CHE 378 | APPLIED SPECTROSCOPY | 4 quarter hours  
(Undergraduate)**

This course serves as an introduction to the methods of structural and spectral analysis typically employed in the identification of organic molecules. Many instrumental techniques exist for the investigation of chemical structures, each of which provides unique information about the composition and structure of a compound. This course does not heavily emphasize the theoretical aspects of spectroscopy and instrumentation, but focusing primarily on the application of these techniques through the interpretation of spectra of organic molecules, and reaction mixtures.

**C- or better in (CHE234 and CHE235) or (CHE238 and CHE239) are prerequisites for this course.**

**CHE 392 | INTERNSHIP | 4 quarter hours  
(Undergraduate)**

Experiential learning experience in a government agency, industrial firm, business, or non-profit organization. (variable credit)

**CHE 397 | RESEARCH | 1-4 quarter hours  
(Undergraduate)**

This course allows a student to work with a faculty member on a research project. Faculty consent and research contract are required to register for the course. This course is typically completed in one to four quarters at the discretion of the research advisor. The student is expected to gain skills in laboratory techniques and procedures in pursuing answers to a research project. (variable credit)

**Junior standing is a prerequisite for this class.**

**CHE 398 | CHEMISTRY THESIS | 1-4 quarter hours  
(Undergraduate)**

This course requires faculty-guided experimental exploration of a research topic and both written (thesis) and oral (seminar and defense) presentation of results. This course is typically completed in two or three quarters (though it may be completed in one quarter at the discretion of the research advisor). The student is expected to gain skills in laboratory techniques and procedures in pursuing answers to a research project. The student will choose a faculty mentor and a project. The project may be based on lab or field research. The grade for the thesis will be based on the written document as well as on the oral seminar and defense presented to the Chemistry students and faculty and the student will graduate "with honors" from the department. This course may be taken more than one time for credit. (variable credit)

**Junior standing is a prerequisite for this class.**

**CHE 399 | INDEPENDENT STUDY | 1-4 quarter hours  
(Undergraduate)**

Independent study of chemistry on an informal basis by an individual in consultation with a department faculty member. Department consent required. (variable credit)

**CHE 422 | INORGANIC STRUCTURE AND REACTIVITY | 4 quarter hours  
(Graduate)**

One of two courses in inorganic chemistry for advanced undergraduates and graduate students in the M.S. program. The course emphasis is variable, but topics covered will include the structure of inorganic compounds and inorganic reaction chemistry.

**CHE 424 | GROUP THEORY | 4 quarter hours  
(Graduate)**

One of two courses in inorganic chemistry for advanced undergraduates and graduate students in the M.S. program. The course emphasis is variable, but the primary topics will be group theory and its application to inorganic compounds.

**CHE 430 | POLYMER SYNTHESIS | 4 quarter hours  
(Graduate)**

This course focuses on the key synthetic organic chemistry methods for making polymers and coatings. A detailed consideration is given to the three types of polymerization reactions: step, chain, and ring-opening polymerizations. Practical application of polymer chemistry in society is a theme throughout the course.

**CHE 432 | PHYSICAL CHEMISTRY OF POLYMERS | 4 quarter hours  
(Graduate)**

This course looks at the broad subject of the physical chemistry of polymers and coatings. A detailed consideration is given to the role of molecular conformation and configuration in determining the physical behavior of polymers. Practical application of physical polymer chemistry in society is a theme throughout the course.

**CHE 434 | POLYMER CHARACTERIZATION | 4 quarter hours  
(Graduate)**

This course looks at the broad subject of polymer characterization. A detailed consideration is given to major methods of analysis of chemical structure, molecular weight, morphology, and rheology. Practical application of polymer characterization in society is a theme throughout the course.

**CHE 436 | POLYMER TECHNOLOGY | 4 quarter hours  
(Graduate)**

This course looks at the broad subject of the polymer and coatings technology. A detailed consideration is given to polymerization processes, and polymer and coatings processing. Practical application of polymer and coatings technology in society is a theme throughout the course.

**CHE 438 | MATERIAL SCIENCE | 4 quarter hours  
(Graduate)**

This course will introduce the fundamentals of biomaterials and the interface between material science and biomedicine. We will review the basic chemical principles of material structures and investigate the physical and mechanical properties of the main classes of biomaterials (metals, ceramics, and polymers). The course will analyze key material properties such as degradation, biocompatibility, and mechanical strength for various biomedical applications. The class will also explore other specialty topics such as supramolecular polymers and nanomaterials. The material will be covered through lectures, online quizzes, homework assignments, manuscript discussions and oral presentations.

**CHE 442 | PROTEIN STRUCTURE AND FUNCTION | 4 quarter hours  
(Graduate)**

One of two courses in biochemistry for advanced undergraduates and graduate students in the M.S. program. An in-depth exploration of protein structure and function, this course surveys the common experimental and bioinformatics methods used by modern biochemists to study protein structure, folding, evolution, engineering, conformational dynamics, and enzymatic reactivity. Students will gain experience with and working knowledge of online databases and tools used by biochemists to formulate and test hypotheses related to the topics of the course.

**CHE 444 | ADVANCED TOPICS IN PROTEIN BIOCHEMISTRY | 4 quarter hours  
(Graduate)**

One of two courses in biochemistry for advanced undergraduates and graduate students in the M.S. program. Discussion and seminars in selected areas.

**CHE 450 | ADVANCED MECHANISTIC ORGANIC CHEMISTRY | 4 quarter hours  
(Graduate)**

One of two courses in organic chemistry for advanced undergraduates and graduate students in the M.S. program. This course emphasizes physical organic chemical models and experimental methods that are used to understand, predict, and control the outcomes of reactions in organic chemistry.

**CHE 452 | ADVANCED SYNTHETIC ORGANIC CHEMISTRY | 4 quarter hours  
(Graduate)**

One of two courses in organic chemistry for advanced undergraduates and graduate student in the M.S. program. This course emphasized classic and modern synthetic methods.

**CHE 464 | COATINGS SCIENCE AND TECHNOLOGY | 4 quarter hours  
(Graduate)**

This course will provide a concise review of the current scientific understanding in the field of polymer and coatings science with numerous practical applications to produce a basic understanding of polymers and coatings technology.

**CHE 470 | STATISTICAL THERMODYNAMICS | 4 quarter hours (Graduate)**

One of three courses in physical chemistry for advanced undergraduates and graduate students in the M.S. program. CHE470 is a course designed to provide an in-depth presentation of thermodynamics from a molecular perspective. The course builds upon foundations given in undergraduate courses on quantum chemistry, and thermochemistry. Starting with some basic principles of probability and probability distribution, it proceeds to the Boltzmann distribution law, and an introduction to microcanonical ensembles; then using the expressions of the quantum energy levels of some simple models, a systematic exploration of the proper formulation, evaluation, and application of partition functions is given. In short, this course develops a methodology to compute thermodynamic properties of macroscopic systems from knowledge of the quantized energies of individual molecules.

**CHE 472 | MOLECULAR DYNAMICS | 4 quarter hours (Graduate)**

One of three courses in physical chemistry for advanced undergraduates and graduate students in the M.S. program. CHE472 builds upon topics covered in a typical undergraduate-level course on chemical kinetics. Here, focus is placed on kinetics at the molecular level with an aim to understand how a reaction system behaves as it passes over a potential energy surface. Depending on time and student interest, specific topics in this course may include reaction rate theory, scattering theory, and surface interactions. Computer simulations may also be incorporated in this course.

**CHE 474 | ADVANCED QUANTUM CHEMISTRY | 4 quarter hours (Graduate)**

One of three courses in physical chemistry for advanced undergraduates and graduate students in the M.S. program. CHE474 is focused on quantum mechanics and will build on fundamental principles introduced in undergraduate quantum chemistry, including an examination of the particle-in-a-box, rigid rotor, and harmonic oscillator models. More advanced quantum mechanical topics such as the Dirac representation, wave packet motion, and time-dependent perturbation theory may also be explored. These topics can be used to understand phenomena such as coherent control of reactions, vibrational energy redistribution, and electronic energy transfer. The primary goals of this course are to: 1) increase students' understanding of quantum mechanical principles; 2) apply quantum mechanics to spectroscopic problems; and 3) expose students to modern literature related to quantum mechanics.

**CHE 480 | SPECIAL TOPICS IN ANALYTICAL CHEMISTRY | 4 quarter hours (Graduate)**

This course may be any topic related to chemical analysis, such as mass spectroscopy, electrochemical analysis, principles of chromatography, polymer properties, coatings, sampling methods, design of experiments, etc. This course may be repeated if the topics are different..

**CHE 482 | SPECIAL TOPICS IN BIOCHEMISTRY | 4 quarter hours (Graduate)**

This course may cover any topic related to biochemistry or medicinal chemistry. This course may be repeated if the topics are different.

**CHE 484 | SPECIAL TOPICS IN INORGANIC CHEMISTRY | 4 quarter hours (Graduate)**

This course may cover any topic related to inorganic chemistry. This course may be repeated if the topics are different.

**CHE 486 | SPECIAL TOPICS IN ORGANIC CHEMISTRY | 4 quarter hours (Graduate)**

This course may cover any topic related to organic chemistry. This course may be repeated if the topics are different.

**CHE 488 | SPECIAL TOPICS IN PHYSICAL CHEMISTRY | 4 quarter hours (Graduate)**

This course covers specific topics in the area of physical chemistry. Examples of topics include single molecule techniques, molecular electronic spectroscopy, interaction of electromagnetic radiation with particulate matter, and hydrogen bonding. This course may be repeated if the topics are different.

**CHE 494 | SCIENCE WRITING AND COMMUNICATION | 4 quarter hours (Graduate)**

The goal of this course is to prepare students to be effective writers and communicators in academic and industrial settings. The course is organized around learning how to write a scientific argument via modules that cover the nature of scientific fact, different genres of scientific writing (e.g., reports and proposals), writing collaboratively and presenting a scientific argument to a stakeholder audience.

**CHE 497 | RESEARCH | 1-12 quarter hours (Graduate)**

This course requires independent experimental exploration under the supervision of a faculty member. Thesis students must write a thesis based on their research project and successfully complete a two-part oral exam. The first part of the examination consists of the thesis presentation and defense; the second part is an oral examination concerning the student's general knowledge of chemistry. (variable credit)

**CHE 499 | INDEPENDENT STUDY | 4.00 quarter hours (Graduate)**

This course is for Master's students. Topic of the course varies. Credit hours vary. Course requires graduate program director approval each quarter.

**CHE 502 | CANDIDACY MAINTENANCE | 0 quarter hours (Graduate)**

This course is meant for Master's students not actively working on their thesis or final project. It is only used to maintain active student status. It will not give the student full- or half-time enrollment status and will not permit deferment of student loans. Course requires graduate program director approval each quarter. (0 credit hours)