### Chemistry (CHM) - Courses

+ next to a course number indicates a general education course

#### Courses

**+CHM 100 Cr.4**
**Contemporary Chemistry**
A survey course focusing on applied chemistry. Fundamental chemistry and science concepts are developed and then used to study applications of this science to technology in society. Emphasis is placed on selected topics that are current. Course is not applicable to a major or minor in chemistry and does not meet the prerequisite requirement of any other chemistry course. Lect. 3, Lab 2. Offered Fall.

**+CHM 103 Cr.5**
**General Chemistry I**
An introduction to chemistry including topics in atomic structure, chemical bonding, molecular structure, chemical stoichiometry, reactivity, states of matter, solutions, acid-base theory, and nuclear chemistry, and also including selected topics in descriptive and applied chemistry. Scientific inquiry, experimental design and data analysis are included. Lect. 3, Lab 3, Disc. 1. Prerequisite: grade of "C" or better in CHM 100. Offered Fall, Spring, Summer.

**CHM 104 Cr.5**
**General Chemistry II**
The second half of the two-semester sequence in general chemistry. The course provides an introduction to the topics of chemical kinetics, equilibria in the gas and solution phases, acid-base chemistry, solubility, thermochemistry, and electrochemistry. The laboratory portion of the course serves to reinforce and demonstrate the above concepts through experimentation. Lect. 3, Lab. 3, Disc. 1. Prerequisite: grade of "C" or better in CHM 103. Students who have completed this course or who are currently enrolled may not register for this course again until after freshman registration (unless they have instructor/department consent). Offered Fall, Spring.

**CHM 250 Cr.3**
**Introduction to Organic and Biochemistry**
A survey course focusing on basic organic and biochemistry with applications to chemical processes in human and other living systems. Course is not applicable to a major or minor in chemistry and does not meet the prerequisite requirement of any other chemistry course. Prerequisite: grade of "C" or better in CHM 103. Students with credit in CHM 300 or CHM 325 cannot earn credit in CHM 250. Offered Spring.

**CHM 271 Cr.1**
**The Chemical Community**
A sophomore level course for chemistry and biochemistry majors that exposes students to scientific communication (writing, speaking, presenting), the chemical literature and how to search it, potential careers in chemistry and career preparation, student opportunities such as internships and undergraduate research, and current and historical topics in chemistry including ethics in science. Students are expected to participate in discussions and complete various writing and presentation assignments. Prerequisite: CHM 104; sophomore standing; chemistry or biochemistry major. Offered Fall.

**CHM 299 Cr.1**
**Chemistry Tutor Training Practicum**
This course is designed to offer training and supervision for tutors in the Murphy Learning Center. The course will include an overview of peer tutoring and learning theory, an overview of the general tutoring process, and an examination of best practices for tutoring various client populations. Students will develop a reflective tutoring practice based on readings and course discussions. The course must be taken during the student’s first semester of employment in the Learning Center. Failure to complete the course will result in termination from the Learning Center. Students who repeat the course will engage more deeply with the content and provide meaningful insights for their peers. Repeatable for credit - maximum three. Consent of instructor. Pass/Fail grading. Offered Fall, Spring.

**CHM 300 Cr.5**
**Survey of Organic Chemistry**
A survey of the properties, reactions, and uses of the major classes of organic compounds. Theories to relate the structure of organic molecules to their chemical reactions is presented as a unifying principle. Applications of organic chemistry to the life sciences and to environmental problems are emphasized. A terminal organic chemistry course recommended for students in the allied health sciences when only one semester of organic chemistry is required. Lect. 3, Lab. 4. Course is not applicable to a major in chemistry. Prerequisite: CHM 104; sophomore standing. Students with credit in CHM 303 cannot earn credit in CHM 300. CHM 300 does not satisfy the prerequisite requirement for CHM 304. Offered Fall, Spring.

**CHM 301 Cr.5**
**Analytical Chemistry**
Theory and practice of selected methods of chemical analysis. Titrimetric, potentiometric, spectrophotometric and gas chromatographic methods of analysis are studied. Statistical treatment of data and techniques for quality assurance are also developed. The basic science component in the course is primarily directed towards ionic equilibria. Lect. 3, Lab 6. Prerequisite: CHM 104; sophomore standing. Offered Fall, Spring.

**CHM 303 Cr.3**
**Organic Chemistry Theory I**
A study of the structure, methods of structure determination, stereochemistry and chemical behavior of hydrocarbons, alcohols, and halogenated hydrocarbons. Theories and mechanisms are introduced to explain chemical behavior. Prerequisite: CHM 104; sophomore standing. Students with credit in CHM 300 cannot earn credit in CHM 303. Offered Fall, Spring.

**CHM 304 Cr.3**
**Organic Chemistry Theory II**
A study of organic synthesis, common functional groups, carbanions, reaction mechanisms, lipids, carbohydrates, proteins and polymers. Prerequisite: CHM 303. Offered Fall, Spring.

**CHM 305 Cr.2**
**Organic Chemistry Laboratory**
An introduction to common laboratory practices in organic chemistry. Experiments are designed to illustrate synthetic and separation techniques. Organic qualitative analysis is included. Lab 6. Prerequisite: CHM 304 or concurrent registration. Students with credit in CHM 300 cannot earn credit in CHM 305. Offered Fall, Spring.
CHM 309 Cr.3
Physical Chemistry Theory I
A study of real gases, equations of state, kinetic and molecular theory, properties of gases, molecular energies, classical thermodynamics, chemical equilibria, changes of state and reaction kinetics and mechanisms. Prerequisite: CHM 104; PHY 103 or PHY 203; PHY 104 or PHY 204; MTH 310 or concurrent enrollment. Offered Fall.

CHM 310 Cr.3
Physical Chemistry Theory II
Quantum mechanics, atomic and molecular spectroscopy, molecular structure, lasers, statistical thermodynamics, and other special topics are covered in this course. Prerequisite: CHM 309. Offered Spring.

CHM 313 Cr.3
Physical Chemistry Laboratory
A lecture and laboratory course designed to teach, illustrate, and strengthen basic concepts in experimental physical chemistry. Topics include thermodynamics, kinetics, introductory spectroscopy, computational chemistry, and statistical error analysis. Students will be exposed to current techniques and equipment used in investigating physical chemistry questions, and will design and implement an independent project of their choosing. A significant emphasis is placed on the development of excellence in both oral and written scientific communication. Lect. 1, Lab 6. Prerequisite: CHM 309. Offered Fall, Spring.

CHM 314 Cr.2
Advanced Physical Chemistry Laboratory
A lecture and laboratory course designed to teach, illustrate, and strengthen concepts in the physical aspects of experimental and computational physical chemistry. Topics may include infrared and UV/visible absorption spectroscopies, fluorescence spectroscopy, NMR spectroscopy, computational modeling of potential energy surfaces, chemical properties, molecular structures, and advanced topics in thermodynamics and kinetics. Students will be exposed to a selection of current experimental techniques, equipment, and basic programming skills, and will have the opportunity to design and implement extensions to selected experiments. A significant emphasis is placed on the development of excellence in both oral and written scientific communication. Lect. 1, Lab 3. Prerequisite: CHM 313; CHM 310 or concurrent enrollment. Offered Occasionally.

CHM 320 Cr.1-3
Practicum in Chemistry
A course designed for and adapted to the specific needs of select groups having specific interests in the applications of techniques and/or theories of chemistry, i.e., educational professionals, chemical technicians, medical technologists, etc. Lecture and laboratory will be adapted to the topic being taught. May be repeated for credit when different topic is presented. Prerequisite: to be determined - based on topic offered. Not applicable to a major in chemistry. Offered Occasionally.

CHM 322 Cr.3
Polymer Chemistry
An introduction to commercially and scientifically important polymer systems. Topics include mechanisms of polymer formation, effects of chemical structure on polymer morphology, polymer structure-property relationships, molecular weights and molecular weight distributions. Characterization of polymers by thermal, physical and spectroscopic methods will be covered in detail. Polymer blends, co-polymers and polymer recycling will also be examined. Prerequisite: CHM 300 or CHM 304. Offered Fall - Even Numbered Years.

CHM 323 Cr.2
Polymer Chemistry Laboratory
A practical introduction to the application of important techniques for polymer synthesis and characterization. Various polymerization approaches will be covered including bulk, solution and emulsion polymerization processes. Methods for analyzing molecular weights and molecular weight distributions will be employed. Instrumental techniques for the characterization of thermal, mechanical and surface properties of polymeric materials will also be emphasized. Lec. 1, Lab 3. Prerequisite: CHM 322. Offered Spring - Odd Numbered Years.

CHM 325 Cr.4
Fundamental Biochemistry
A survey of chemical processes in biological systems emphasizing the structure, function, and interactions of proteins, nucleic acids, carbohydrates, lipids, the regulation of cellular processes, and a description of certain clinical disorders. Lect. 3, Lab 3. Prerequisite: CHM 300 or CHM 304. Students with credit in CHM 417 cannot earn credit in CHM 325. Offered Fall, Spring.

CHM 330 Cr.3
Industrial Chemistry
An overview of both the scientific and commercial aspects of the chemical industry. Industrially important chemical processes will be discussed. Topics will include production and end use of basic inorganic chemicals of commercial importance, industrial gases, and petroleum-based products. The economics of various chemical processes will be presented. Global and local topics such as regulatory compliance, product liability, and patent/trade secret documentation may also be discussed. Prerequisite: CHM 300 or CHM 303. Offered Spring - Even Numbered Years.

CHM 331 Cr.4
Fundamentals of Inorganic Chemistry
A foundational course in inorganic chemistry intended to provide exposure to and understanding of the composition, structure, bonding properties and reactivity of inorganic compounds, and basic laboratory techniques and practice commonly applied to inorganic compounds. Lect. 3, Lab 3. Prerequisite: grade of "C" or better in CHM 104. Offered Fall.

BIO/CHM/PHY 356 Cr.2
Curriculum and Assessment in Math and Science
Students are introduced to state and national content standards and related theories on teaching and learning. They will apply this knowledge to develop a curricular framework. Topics will include: Learning outcomes, student misconceptions, balanced assessment, and lesson planning in the content areas. Prerequisite: declared math or science education major/minor; admission to teacher education. (Cross-listed with BIO/CHM/PHY; may only earn credit in one department.) Offered Fall.

CHM 361 Cr.3
Radiochemistry
A study of the decay of radioactive elements, detection of radiation, methods of analysis and applications such as neutron activation and radioactive dating. Lect. 2, Lab 2. Prerequisite: three semesters of chemistry courses. Students with credit in CHM 461 cannot earn credit in CHM 361. Offered Occasionally.

CHM 403 Cr.3
Advanced Organic Chemistry
Advanced topics in organic chemistry, including reaction mechanisms, molecular orbital theory, conservation of orbital symmetry, pericyclic reactions, photochemistry, aromaticity, stereochemistry, kinetics, isotope effects, linear free energy relationships, hard-soft acid-base theory, and selected examples of recent advances in synthetic organic chemistry. Prerequisite: CHM 304. Offered Fall - Even Numbered Years.
CHM 405 Cr.2

Advanced Organic Synthesis
An advanced course in organic chemistry intended to provide students with organic synthesis techniques that can be applied to many areas of research, and expose them to diverse fields of study including chemistry, biochemistry, and chemical biology. Specific topics will include protein labeling, biologically-compatible click chemistry, and natural product synthesis. Lab 6. Prerequisite: "C" or better in CHM 304 and CHM 305. Offered Spring - Odd Numbered Years.

CHM 407 Cr.3

Biophysical Chemistry
A study of the physical principles that drive the structure and behaviors of biological molecules. Topics include the relationship between the properties of biomolecular building blocks and macromolecular structure; application of different physical models (thermodynamic, quantum mechanical, statistical mechanical) to the characterization of macromolecular structure and behavior; application of physical techniques (spectroscopy, calorimetry, etc.) to the characterization of macromolecular structure and behavior. Prerequisite: CHM 417 or CHM 325; MTH 207; MTH 208 or MTH 265 or concurrent enrollment; PHY 103 or PHY 203; PHY 104 or PHY 204. Offered Spring.

CHM 412/512 Cr.3

Environmental Chemistry
This course examines the role of chemistry in shaping our environment, including atmospheric, aqueous, and terrestrial components. Students learn how fundamental chemical principles are applied to complex real systems in order to characterize environmental behavior and aid in prediction and decision making. Specific topics explored include climate change, ozone depletion, smog formation, water quality and treatment, energy policy, and the fate/transport of pollutants. Prerequisite: CHM 417; junior standing. Offered Spring.

CHM 413 Cr.2

Environmental Chemistry Laboratory
An exploration of chemical reactivity and measurement in atmospheric, terrestrial, and aquatic ecosystems. Students will collect and analyze environmental samples and perform experiments that validate major topics discussed in CHM 412, Environmental Chemistry lecture. Lab experiments include measurement of the physical/chemical properties and trace contaminants in air, water, and soil; modeling of chemical equilibria related to greenhouse gases, ozone depletion, and acid rain; alternative fuels. Lab 4. Prerequisite: CHM 412 or concurrent enrollment. Offered Spring.

CHM 417/517 Cr.4

Biochemistry I: Macromolecules
A study of the structure and function of biological macromolecules with special emphasis on proteins. Topics include protein folding, protein-ligand interactions, protein function, and membrane structure and function. The laboratory focuses on contemporary biochemical techniques including quantitative biochemical assays, ligand binding, protein purification, and enzyme function. Lect 3, Lab 3. Prerequisite: "C" or better in CHM 300 or CHM 304; junior standing; BIO 315 or MIC 425 recommended. Students with credit in CHM 325 cannot earn credit in CHM 417. Offered Fall.

CHM 418/518 Cr.3

Biochemistry II: Metabolism and Genetic Information
This course provides a comprehensive and integrative approach to fundamental metabolism and the flow of genetic information. In particular, the course emphasizes the chemical principles governing metabolite inter-conversions, energy flow, regulation of metabolic pathways, and the maintenance of genetic information. Prerequisite: "C" or better in CHM 417; junior standing. BIO 306 and BIO 315, or MIC 416 and MIC 425 recommended. Offered Spring.

CHM 419/519 Cr.3

Advanced Biochemistry Lab
A capstone biochemistry laboratory course that provides students with the opportunity to undertake hypothesis-driven research. Students will use a variety of contemporary biochemical and biophysical techniques to study biomolecular structure and function. As the capstone course in the biochemistry major, students will give written and oral reports of their work that incorporate the primary literature. Lect. 1, Lab 6. Prerequisite: "C" or better in CHM 417; CHM 418 or concurrent enrollment; junior standing. Offered Spring.

CHM 421/521 Cr.1-3

Advanced Topics in Chemistry
An advanced topic in chemistry based on appropriate prior work in physical chemistry, organic chemistry, inorganic chemistry, and analytical chemistry. Lecture and laboratory will be adapted to the topic being taught. May be repeated for credit when different topic is presented. Repeatable for credit - no maximum. Prerequisite: determined based on topic offered and will include a minimum of three semesters of chemistry courses; junior standing. Offered Occasionally.

CHM 422/522 Cr.3

Polymer Chemistry
A study of synthetic high molecular weight materials of practical application in industry or of theoretical interest in chemistry. Representative polymer systems are examined with respect to the effect of molecular weight, weight distribution, and structure on physical properties. The choice of monomeric starting materials and mechanisms of polymerization are examined in detail. Methods of characterizing macromolecules are surveyed. Lect. 2, Lab 2. Prerequisite: CHM 304; junior standing. CHM 309 highly recommended. Offered Occasionally.

CHM 424/524 Cr.3

Spectroscopy
A survey of important spectroscopic methods used in chemistry; infrared and ultraviolet, proton and carbon-13 NMR, and mass spectrometry. Theory and practice of techniques are covered. Emphasis is placed on structure determination of organic molecules. Analysis of dynamic systems and mixtures may also be covered. Lect. 2, Lab 3. Prerequisite: CHM 300 or CHM 304; junior standing. Offered Spring - Even Numbered Years.

CHM 431/531 Cr.3

Advanced Inorganic Chemistry
An advanced course in inorganic chemistry building upon foundations presented in CHM 231, intended to highlight a more advanced theoretical treatment of inorganic compounds and reactions and applications of inorganic chemistry principles to catalysis, functional materials, and biological systems. Prerequisite: CHM 231; CHM 310 or concurrent enrollment; junior standing. Offered Spring - Odd Numbered Years.

CHM 441/541 Cr.3

Instrumental Analysis
A study of the theory and principles of chemical instrumentation including the application of basic electronics, spectroscopy, separation science and electroanalytical methods of chemical analysis. Lect. 3, Lab 3. Prerequisite: CHM 301; junior standing. Offered Fall.

CHM 461/561 Cr.4

Nuclear Chemistry
A study of the decay of radioactive nuclides with emphasis on the theory of nuclear decay. Laboratory will include the study of the detection of radiation, methods of radio analysis and the safe handling of unsealed radioactive sources. Lect. 3, Lab 3. Prerequisite: four semesters of chemistry courses; junior standing. Students with credit in CHM 361 cannot earn credit in CHM 461. Offered Spring.
BIO/CHM/PHY 469 Cr.4  
Teaching and Learning Science in the Secondary School  
This course will be integrated with a field experience. In the context of a real classroom, teacher candidates will learn how to plan for and assess student learning in science. With a focus on content knowledge, teacher candidates will plan a variety of meaningful learning experiences, assess student learning, and monitor and modify instruction to best support the individual learners in the classroom. The teacher candidate will design, enact, and assess activities that advance student understanding to more complex levels. Teacher candidates will gain experience in monitoring the obstacles and barriers that some students or groups of students face in school and learn how to design learning experiences to support all learners. Prerequisite: GEO 200; EDS 351. (Cross-listed with BIO/CHM/PHY; may only earn credit in one department.) Offered Fall, Spring.

CHM 487 Cr.1  
Peer Instruction and Learning in Chemistry  
A structured course designed to introduce chemistry education majors and minors (Early Adolescence-Adolescence) to the proper methods of delivering general chemistry concepts to undergraduate students in CHM 103 and CHM 104. Repeatable for credit - maximum two. A maximum of two credits may be applied to the chemistry education major (Early Adolescence-Adolescence). A maximum of one credit may be applied to the chemistry education minor. Prerequisites: CHM 301; chemistry education (EA-A) major or minor plan; chemistry department consent. Consent of department. Offered Fall, Spring.

CHM 489 Cr.1-2  
Independent Study  
Independent study under the direction and supervision of a member of the chemistry faculty. Activities related to chemistry other than those normally considered chemistry research. Repeatable for credit - maximum two. Consent of department. Offered Fall, Spring, Summer.

CHM 499 Cr.1-2  
Research  
Laboratory research under the direction and supervision of a member of the chemistry departmental staff for selected students. A written or oral report will be required. Repeatable for credit - maximum six. A maximum of four credits can be applied to the major in chemistry. A maximum of two credits can be applied to the major in biochemistry. Consent of department. Offered Fall, Spring, Summer.