

# Chemistry (CHE)

## Division of Science and Mathematics

- **Major: 55 credit hours**
- **Minor: 30 credit hours**
- **Major/Minor GPA required for graduation: 2.50**
- **All courses for the major and minor must be completed with a grade of C- or better**

### PROGRAM REQUIREMENTS:

- **Capstone: Chemistry Research Methods (W) (CHE 455)**
- **Research: Chemistry Research Methods (W) (CHE 455)**

**Mission:** The mission of this program is to prepare students with complete core knowledge and skills in chemistry and with supplementary applicable skills in mathematics and physics for success in graduate school, professional school, or employment in chemical industry or technology.

**Description of Major:** Courses in the program are designed to make students competent in the areas of content, critical thinking, laboratory work, and research. Chemistry content courses span the five major fields of general chemistry, organic chemistry, analytical chemistry, physical chemistry, and biochemistry. Supplementary courses establish a strong background in physics and mathematics.

### Student Learning Outcomes

*Students will:*

- Mastery the core concepts of chemistry and integrate them across the major areas of chemistry.
- Develop and practice critical thinking skills in scientific problem solving.
- Comprehend the process of scientific inquiry and develop the ability to conduct original research in chemistry.
- Promote appreciation of the role of chemistry in our society.

**Preparation:** The degree prepares students to enter graduate school in specialized fields of chemistry such as organic chemistry, physical chemistry,

analytical chemistry, biochemistry, materials chemistry, computational chemistry, polymer chemistry, environmental chemistry, atmospheric chemistry, medicinal chemistry, and nuclear chemistry. Chemistry majors may also choose employment in chemical and biochemical research and technology upon graduation.

### CHEMISTRY MAJOR REQUIREMENTS 55 crs.

CHE 105	GENERAL CHEMISTRY I	4
CHE 106	GENERAL CHEMISTRY II	4
CHE 205	ORGANIC CHEMISTRY I	4
CHE 206	ORGANIC CHEMISTRY II	4
CHE 300	ANALYTICAL CHEMISTRY	4
CHE 303	PRINCIPLES OF BIOCHEMISTRY	4
CHE 305	PHYSICAL CHEMISTRY I	4
CHE 306	PHYSICAL CHEMISTRY II	4
CHE 455	CHEMISTRY RESEARCH METHODS	3
MTH 210	CALCULUS I	4
MTH 211	CALCULUS II	4
MTH 212	CALCULUS III	4
PHY 211	GENERAL PHYSICS: MECHANICS, HEAT, SOUND	4
PHY 212	GENERAL PHYSICS: ELECTRICITY, MAGNETISM, OPTICS	4

### RECOMMENDED ELECTIVES

CHE 310	INTRODUCTION TO MOLECULAR MODELING AND BIOINFORMATICS	2
CHE 380-389	SPECIAL TOPICS IN CHEMISTRY	1-3

### CHEMISTRY MINOR REQUIREMENTS 30 crs.

CHE 105	GENERAL CHEMISTRY I	4
CHE 106	GENERAL CHEMISTRY II	4
CHE 205	ORGANIC CHEMISTRY I	4
CHE 206	ORGANIC CHEMISTRY II	4
CHE 300	ANALYTICAL CHEMISTRY	4
CHE 303	PRINCIPLES OF BIOCHEMISTRY	4
CHE 310	INTRODUCTION TO MOLECULAR MODELING AND BIOINFORMATICS	2
MTH 210	CALCULUS I	4

## Chemistry (CHE)

- CHE 100** **3**  
**GENERAL CHEMISTRY FUNDAMENTALS**  
 The course is an examination of general chemistry principles, particularly those necessary for biological sciences and health sciences and assumes no previous background in chemistry. Topics will include dimensional analysis, energy, atomic structure, bonding, intermolecular forces, reactions, gas laws, solutions, and nuclear chemistry. Topics of relevance to chemistry in society will also be discussed. Three hours of lecture.
- CHE 105** **4**  
**GENERAL CHEMISTRY I**  
 Topics covered are: atomic theory and the electronic structure of atoms, molecules, and ions; the periodic table and chemical bonding; molecular geometry and molecular orbitals; physical properties in relation to structure; chemical formulas and equations; the ideal gas law and its uses; solutions (concentration units, principles of solubility); and reactions in aqueous solution (acid-base, precipitation, and redox reactions). Laboratory work is integrated with topics covered in lecture. Three lectures and one three-hour laboratory period per week. Not intended for non-science majors seeking fulfillment of the Science and Nature requirements of the general education program. Prerequisites: 1) Placement into MTH 133, 150, 170, or 210 2) One year of high school laboratory chemistry with a grade of B or better, CHE 100, or instructor consent. A student must pass the laboratory portion of any science course to pass the entire course. IAI-P1902/P1902L
- CHE 106** **4**  
**GENERAL CHEMISTRY II**  
 Topics covered in this course are thermochemistry, spontaneity, and entropy, chemical equilibrium; kinetics; acid-base equilibria; solubility equilibria; liquids, solids, and intermolecular forces; phase behavior; and physical properties of solutions. Laboratory work is integrated with topics covered in lecture. Three lectures and one three-hour laboratory period per week. Not intended for non-science majors seeking fulfillment of the Science and Nature requirements of the general education program. Prerequisite: CHE 105 or equivalent with a grade of C- or better.
- CHE 205** **4**  
**ORGANIC CHEMISTRY I**  
 This course is a foundational survey of general organic chemistry and is concerned with the properties, structure, nomenclature, and reactions of compounds belonging to the major organic chemical families. The functional group approach is used with an emphasis on those of importance in biochemistry. The laboratory component focuses on common techniques used in organic chemistry, as well as elementary organic syntheses and qualitative analysis. Three hours of lecture and three hours of laboratory per week. Prerequisites: CHE 105, 106, or equivalent, with a grade of C- or better. A student must pass the laboratory portion of any science course to pass the entire course.
- CHE 206** **4**  
**ORGANIC CHEMISTRY II**  
 The course focuses on more advanced aspects of the materials surveyed in CHE205. Greater emphasis will be placed on reaction mechanisms, the use of spectroscopic techniques such as IR and NMR for structure determination, synthetic methods, and physical organic concepts and phenomena. The laboratory component focuses on the use of spectroscopic methods of analysis, more advanced syntheses, and more advanced laboratory techniques. The course is designed for chemistry majors and minors and pre-professional students seeking more advanced study. Prerequisite: CHE 205 with a grade of C- or better. A student must pass the laboratory portion of any science course to pass the entire course.
- CHE 280** **1-3**  
**SPECIAL TOPICS IN CHEMISTRY**
- CHE 299** **1-3**  
**PRACTICUM IN CHEMISTRY**  
 For students at the sophomore level or above who wish to arrange a practicum in a laboratory or other appropriate direct-experience learning situation in chemistry. Prerequisites: 15 hours of related coursework, grade point average consistent with departmental graduation requirements, and instructor consent. No more than eight credit hours combined total for this practicum and an internship may be counted as credit toward the major.
- CHE 300** **4**  
**ANALYTICAL CHEMISTRY**  
 Classical and instrumental methods are applied to chemical analysis. Classical methods are gravimetric, volumetric, and chromatographic. Instrumental methods are spectroscopic (IR, UV/VIS, and laser methods), chromatographic (HPLC and GC/MS), and electrochemical (conductometry and potentiometry). Three lectures and one three-hour laboratory period per week. Prerequisites: CHE 105, 106, MTH 210. A student must pass the laboratory portion of any science course to pass the entire course.
- CHE 303** **4**  
**PRINCIPLES OF BIOCHEMISTRY**  
 This course is designed to give an overall understanding and integration of the biochemical principles involved in the structure/function relationships of biological molecules and their interactions in the intermediary metabolism in eukaryotic cells with special emphasis on human metabolism. Four hours lecture. Prerequisites: CHE 206 with a grade of C- or better.
- CHE 305** **4**  
**PHYSICAL CHEMISTRY I**  
 A course that develops, in detail, many of the fundamental concepts used in chemistry. Topics include the study of gases, thermodynamics, thermodynamic properties of liquids and solids, the nature of electrolytes, phase equilibria, and chemical equilibria. Three lectures and one three-hour laboratory period per week. Prerequisites: CHE 105, 106, MTH 211, PHY 211, 212, or concurrent enrollment. A student must pass the laboratory portion of any science course to pass the entire course.

## Chemistry (CHE)

### **CHE 306** **4**

#### **PHYSICAL CHEMISTRY II**

A continuation of Chemistry 305 discussing theories of chemical bonding and molecular structure, spectroscopy, chemical kinetics, quantum mechanics, and molecular energies. The laboratory component includes laser methods to confirm the predictions of quantum mechanics about chemical bonding and molecular energy levels. Three lectures and one three-hour laboratory period per week. Prerequisites: CHE 305, MTH 212, or concurrent enrollment. A student must pass the laboratory portion of any science course to pass the entire course.

### **CHE 310** **2**

#### **INTRODUCTION TO MOLECULAR MODELING AND BIOINFORMATICS**

Through the hands-on web-exercises, students will learn to use the Databases (GenBank, OMIM, UniProt, PDB, and PubMed), Search Tools (BLAST and NCBI Map Viewer), Analysis Tools (ExPASy, PROSITE, ClustalW, and Phylip), and Modeling Tools (Swiss-Model and Deep View). Students will apply what they learn during in-class exercises to complete several projects on their chosen protein during the semester. Two hours lecture. Prerequisite: CHE 303 or instructor consent.

### **CHE 380-389** **1-3**

#### **SPECIAL TOPICS IN CHEMISTRY**

Prerequisite: Instructor consent.

### **CHE 455** **3**

#### **CHEMISTRY RESEARCH METHODS (W)**

This is the capstone course in chemistry. An overview of current chemistry research areas will be examined, and students will develop the scientific reasoning and critical thinking skills necessary to communicate effectively science using a variety of formats. The focus will be on critical analysis of primary literature and data, scientific writing, and scientific presentations. Prerequisites: Chemistry major, senior standing.

### **CHE 470** **3-8**

#### **INTERNSHIP IN CHEMISTRY**

### **CHE 480** **1-4**

#### **INDEPENDENT STUDY IN CHEMISTRY**