CHEMISTRY, BS

Program Description
The chemistry faculty seeks to provide a high quality educational experience for students majoring in chemistry in preparation for industrial or government positions, for graduate study, and for entry to medical or dental schools. The program is also designed for those planning to teach chemistry or physics at the 7-12 level, or who need chemical knowledge and skills relevant to future studies in the sciences.

Student Learning Outcomes
Students will:
- Demonstrate a broad understanding of chemical concepts
- Analyze and interpret a variety of chemical data
- Communicate chemical information effectively at the undergraduate level, in oral and written form, with appropriate use of technology

The student who wishes to obtain a Bachelor of Science Degree in Chemistry may do so by following one of the four curriculum plans referred to as Concentrations. The options include general, environmental, biochemistry, and physical science education concentrations. Students who are pre-medical, pre-dental, pre-optometry, pre-pharmacy, or pre-veterinary medicine may follow the biochemistry concentration. In addition, the biochemistry concentration offers an option which would allow students to pursue certification in clinical chemistry while obtaining their Bachelors in Chemistry.

A prospective 7-12 physical science (chemistry or physics) teacher could obtain a BS in Chemistry while following the physical science education concentration. Details on the requirements for the physical science education concentration and for obtaining a teaching certificate are in the College of Science and Engineering: Science, Mathematics and Technology Education section of this catalog.

The BS in Chemistry requires at least 120 semester hours with a university required minimum number of 45 upper-division hours. Students may have to take additional hours to meet university general education requirements such as First-Year Seminar courses. The major consists of at least 52 semester hours (24 upper-division), some of which may be designated courses outside of chemistry. Every candidate for the BS in Chemistry following the general, environmental, or biochemistry concentration must complete the CHEM 4085 Major Field Test in Chemistry (0 sch) during their senior year, prior to graduation. The details of the general, environmental, and biochemistry concentrations follow.

General Requirements

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-Year Seminars (when applicable)</td>
<td>0-2</td>
</tr>
<tr>
<td>Core Curriculum Program</td>
<td>42</td>
</tr>
<tr>
<td>Special Foundations</td>
<td>21</td>
</tr>
<tr>
<td>Chemistry Major (depends on area of concentration)</td>
<td>45-46</td>
</tr>
<tr>
<td>Electives (depends on area of concentration)</td>
<td>9-10</td>
</tr>
</tbody>
</table>

| Total Credit Hours | 117-121 |

Program Requirements

Full-time, First-year Students
- UNIV 1101 First-Year Seminar I (1 sch)
- UNIV 1102 First-Year Seminar II (1 sch)

Core Curriculum Program
- University Core Curriculum 42

Students majoring in chemistry should take:
- CHEM 1411 General Chemistry I (Life and Physical Sciences component)
- CHEM 1412 General Chemistry II (Life and Physical Sciences component)
- MATH 2413 Calculus I (Mathematics requirement)
- MATH 2414 Calculus II (Component Area Option)

Special Foundations
Select one of the following Concentrations:
- General Concentration (p. 1)
- Environmental Concentration (p. 2)
- Biochemistry/Preprofessional Concentration (p. 2)

Chemistry Major
Select one of the following Concentrations:
- General Concentration (p. 1)
- Environmental Concentration (p. 2)
- Biochemistry/Preprofessional Concentration (p. 2)
- Physical Science Education Concentration (p. 3)

Electives
Courses may be selected from any area to accumulate a total of 120 9-10 semester hours with the required number of upper-division hours. In some cases these hours may be used to obtain a minor in another subject

Total Hours 119-121

1. Full-time, first time in college students are required to take the first-year seminars.

2. University Physics I
3. University Physics II
4. Biology, Geology, or Environmental Science

Concentrations

Chemistry General Concentration

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>PHYS 2425</td>
<td>University Physics I</td>
<td>4</td>
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<tr>
<td>PHYS 2426</td>
<td>University Physics II</td>
<td>4</td>
</tr>
<tr>
<td>Biology, Geology, or Environmental Science</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

1. Note for 4 hours courses such as General Chemistry and Calculus that are taken as Foundational Component Area requirements, students may count the extra 1 credit hour of each course as part of the Component Area Option (to a maximum of three credit hours).

2. Online offering
Environmental Chemistry Concentration

Chemistry Major

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1411</td>
<td>General Chemistry I (included in Core)</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 1412</td>
<td>General Chemistry II (included in Core)</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 3411</td>
<td>Organic Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 3412</td>
<td>Organic Chemistry II</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 3417</td>
<td>Quantitative Analysis</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 3418</td>
<td>Instrumental Analysis</td>
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</tr>
<tr>
<td>CHEM 4085</td>
<td>Major Field Test in Chemistry</td>
<td>0</td>
</tr>
<tr>
<td>CHEM 4423</td>
<td>Biochemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 4292</td>
<td>Advanced Inorganic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 4401</td>
<td>Biochemistry I</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 4407</td>
<td>Advanced Inorganic Chemistry</td>
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<tr>
<td>CHEM 4408</td>
<td>General Chemistry II</td>
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Select 12 hours of the following:

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<tr>
<th>Code</th>
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</thead>
<tbody>
<tr>
<td>CHEM 4443</td>
<td>Environmental Chemistry</td>
<td>4</td>
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</tbody>
</table>

Total Hours 81

1. Nine of the 12 hours from General Chemistry I & II and Calculus I should be used to fulfill the University Core Curriculum Life and Physical Sciences and the Math components of the University Core Curriculum requirements. The other three hours of the lab portion of those courses should be used to fulfill three hours of the Component Area Option of the University Core Curriculum requirements.

2. Calculus II should be used to fulfill the other 3 hours of the Component Area Option. See catalog section on University Core Curriculum Programs.

* Online offering

Biochemistry/Preprofessional Concentration

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<tr>
<th>Code</th>
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<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>BIOL 1406</td>
<td>Biology I</td>
<td>4</td>
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<tr>
<td>BIOL 1407</td>
<td>Biology II</td>
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<tr>
<td>MATH 1442</td>
<td>Statistics for Life</td>
<td>4</td>
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<tr>
<td>MATH 2413</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 2414</td>
<td>Calculus II</td>
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Chemistry Major

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<td>CHEM 4085</td>
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<tbody>
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<td>MATH 2415</td>
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<tr>
<td>BIOL 2416</td>
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<td>4</td>
</tr>
<tr>
<td>BIOL 2421</td>
<td>Microbiology</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 3411</td>
<td>Organic Chemistry I</td>
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2. Calculus II should be used to fulfill the other 3 hours of the Component Area Option. See catalog section on University Core Curriculum Programs.

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Biochemistry/Preprofessional Concentration

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Chemistry Major

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</table>
Chemistry, BS

CHEM 4320  Drugs, Toxins and Natural Products Chemistry
CHEM 4350  Polymer Chemistry
CHEM 4407  Advanced Inorganic Chemistry
CHEM 4420  Physical Biochemistry
CHEM 4424  Physical Chemistry II
CHEM 4443  Environmental Chemistry

Total Hours 81

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2. Calculus II should be used to fulfill the other 3 hours of the Component Area Option. See catalog section on University Core Curriculum Programs.

* Online offering
^ Blended offering

Physical Science Education Concentration
Information on the physical science education concentration and requirements for teaching certification can be found in the College of Science and Engineering: Science, Mathematics and Technology Education section of the catalog.

Courses

CHEM 1305  Introductory Chemistry
3 Semester Credit Hours (3 Lecture Hours)
A ONE-SEMESTER PRINCIPLES COURSE FOR STUDENTS IN NON-SCIENCE RELATED MAJORS COVERING THE MAJOR CONCEPTS OF CHEMISTRY (ATOMIC STRUCTURE, BONDING, STOICHIOMETRY, ELEMENTARY THERMODYNAMICS) AND THE ROLE OF CHEMISTRY IN CONTEMPORARY SOCIETY (POLYMERS, ENERGY, POLLUTION, ETC.). WILL NOT SUBSTITUTE FOR CHEM 1411.
TCCNS: CHEM 1305

CHEM 1411  General Chemistry I
4 Semester Credit Hours (4 Lecture Hours)
THE FOUNDATION COURSE IN CHEMISTRY. STOICHIOMETRY, CHEMICAL EQUILIBRIA, ATOMIC STRUCTURE, CHEMICAL BONDING, PERIODIC PROPERTIES, THERMODYNAMICS, CHEMICAL KINETICS, AND DESCRIPTIVE CHEMISTRY OF THE ELEMENTS. LABORATORY INVOLES DEVELOPMENT OF BASIC SKILLS. THIS COURSE COUNTS TOWARD THE NATURAL SCIENCE COMPONENT OF THE UNIVERSITY CORE CURRICULUM. EITHER CHEM 1305 - INTRODUCTORY CHEMISTRY OR CHEM 1411, BUT NOT BOTH, MAY BE APPLIED TOWARDS THE CORE REQUIREMENT. THIS COURSE IS OFFERED IN FALL, SPRING AND TYPICALLY DURING BOTH SUMMER SESSIONS .
Co-requisite: SMTE 0093.
TCCNS: CHEM 1411

CHEM 1412  General Chemistry II
4 Semester Credit Hours (4 Lecture Hours)
THE CONTINUATION OF CHEM 1411 - GENERAL CHEMISTRY I*, THE FOUNDATION COURSE IN CHEMISTRY WITH EMPHASIS ON QUANTITATIVE ASPECTS. LABORATORY INVOLVES DEVELOPMENT OF BASIC SKILLS. THIS COURSE COUNTS TOWARD THE NATURAL SCIENCE COMPONENT OF THE UNIVERSITY CORE CURRICULUM. PREREQUISITE: CHEM 1411 - GENERAL CHEMISTRY I* AND MATH 1314 - COLLEGE ALGEBRA OR EQUIVALENT MATH COMPETENCY. THIS COURSE IS OFFERED IN FALL, SPRING AND TYPICALLY BOTH SUMMER SESSIONS.
Prerequisite: CHEM 1411 and MATH 1314.
Co-requisite: SMTE 0093.
TCCNS: CHEM 1412

CHEM 2490  Special Topics
4 Semester Credit Hours (1-4 Lecture Hours, 3 Lab Hours)
MAY BE REPEATED FOR CREDIT. SUBJECT MATERIALS VARIABLE. OFFERED ON SUFFICIENT DEMAND.

CHEM 3411  Organic Chemistry I
4 Semester Credit Hours (4 Lecture Hours)
THE STRUCTURE, NOMENCLATURE, SYNTHESIS, REACTIONS, AND REACTION MECHANISMS OF THE PRINCIPAL CLASSES OF ORGANIC COMPOUNDS. STEREOCHEMISTRY AND SPECTROSCOPY OF ORGANIC COMPOUNDS. LABORATORY INVOLVES SEPARATION AND SYNTHETIC TECHNIQUES AND DEVELOPMENT OF BASIC SKILLS. THIS COURSE IS OFFERED IN FALL, SPRING AND TYPICALLY DURING THE SUMMER I SESSION.
Prerequisite: CHEM 1411.
Co-requisite: SMTE 0093.

CHEM 3412  Organic Chemistry II
4 Semester Credit Hours (4 Lecture Hours)
A CONTINUATION OF CHEM 3411. THE COURSE CONCLUDES WITH A SURVEY OF THE STRUCTURES OF BIOMOLECULES. LABORATORY INVOLVES SPECTROSCOPY AND QUALITATIVE ANALYSIS TECHNIQUES. THIS COURSE IS OFFERED IN FALL, SPRING AND TYPICALLY DURING THE SUMMER II SESSION.
Prerequisite: CHEM 3411.
Co-requisite: SMTE 0093.

CHEM 3417  Quantitative Analysis
4 Semester Credit Hours (4 Lecture Hours)
A COURSE IN QUANTITATIVE ANALYSIS, WHICH INCLUDES CHEMICAL STATISTICS AND THE USE OF ACID-BASE, COMPLEXATION, PRECIPITATION, AND REDOX REACTIONS TO PERFORM ANALYSES AND SEPARATIONS. LABORATORY INCLUDES STANDARD VOLUMETRIC AND GRAVIMETRIC METHODS AND DEVELOPMENT OF BASIC QUANTITATIVE TECHNIQUES. THIS COURSE IS TYPICALLY OFFERED IN SPRING.
Prerequisite: CHEM 1412.
Co-requisite: SMTE 0093.

CHEM 3418  Instrumental Analysis
4 Semester Credit Hours (4 Lecture Hours)
AN INTRODUCTION TO INSTRUMENTAL METHODS OF ANALYSIS: SPECTROSCOPY, CHROMATOGRAPHY, AND ELECTROCHEMICAL METHODS. LABORATORY INVOLVES USE OF INSTRUMENTATION IN CHEMICAL ANALYSIS. THIS COURSE IS TYPICALLY OFFERED IN FALL AND SPRING.
Prerequisite: CHEM 1412.
Co-requisite: SMTE 0093.
CHEM 4085 Major Field Test in Chemistry
0 Semester Credit Hours
THE MAJOR FIELD TEST (MFT) IN CHEMISTRY IS A NATIONAL EXAMINATION GIVEN IN THE FALL AND SPRING SEMESTERS ONLY. IT IS A GRADUATION REQUIREMENT FOR ALL CHEMISTRY STUDENTS. STUDENTS ENROLL IN THIS COURSE DURING THE SEMESTER THAT THEY PLAN TO TAKE THE MFT. THERE IS NO COST TO THE STUDENT FOR EITHER THIS COURSE OR FOR THE MFT.

CHEM 4292 Senior Chemistry Seminar
2 Semester Credit Hours (2 Lecture Hours)
PRESENTATION AND DISCUSSION OF SELECTED TOPICS IN CHEMISTRY. INCLUDES LITERATURE SEARCHES AND REVIEWS, PAPER PRESENTATIONS, SURVEY OF PROFESSIONAL OPPORTUNITIES AND REQUIREMENTS, CAREER GUIDANCE AND JOB SEARCHING SKILLS.

CHEM 4309 Advanced Instrumental Analysis
3 Semester Credit Hours (3 Lecture Hours)
AN ADVANCED COURSE IN ANALYTICAL CHEMISTRY COVERING THE UNDERLYING THEORIES OF INSTRUMENTAL METHODS. THIS COURSE IS TYPICALLY OFFERED ON AN IRREGULAR BASIS.
Prerequisite: (CHEM 3411, 3412 and 3418).

CHEM 4320 Drugs, Toxins and Natural Products Chemistry
3 Semester Credit Hours (3 Lecture Hours)
THE CHEMISTRY AND BIOLOGICAL ACTIVITY OF PHARMACEUTICALS, TOXINS AND SELECTED NATURAL PRODUCTS. EXAMINES HOW CHEMICAL STRUCTURE RELATES TO BIOLOGICAL ACTIVITY. ALSO EXAMINES ACTION OF ANTIBIOTICS, CHEMOTHERAPY AGENTS, ANALGESICS, STEROIDS, AND COMPOUNDS TARGETING THE CENTRAL AND PERIPHERAL NERVOUS SYSTEM. THIS COURSE IS TYPICALLY OFFERED IN FALL AND SPRING.
Prerequisite: CHEM 4401.

CHEM 4344 Chemical Oceanography
3 Semester Credit Hours (3 Lecture Hours)
THE STUDY OF THE OCEANS AND SEAS AS A CHEMICAL SYSTEM, INCLUDING INTERACTIONS WITH BOTH THE BIOTA AND THE SOLID EARTH. THIS COURSE IS TYPICALLY OFFERED IN SPRING.
Prerequisite: CHEM 1412.

CHEM 4350 Polymer Chemistry
3 Semester Credit Hours (3 Lecture Hours)
AN ADVANCED LECTURE COURSE IN ORGANIC CHEMISTRY. CHARACTERIZATION OF POLYMERS. POLYMERIZATION MECHANISMS. CURRENT RESEARCH DIRECTIONS SUCH AS BIOMEDICAL APPLICATIONS AND ELECTROACTIVE POLYMERS. THIS COURSE IS OFFERED ON AN IRREGULAR BASIS.
Prerequisite: CHEM 3412.

CHEM 4401 Biochemistry I
4 Semester Credit Hours (4 Lecture Hours)
THE STRUCTURE AND FUNCTION OF CARBOHYDRATES, LIPIDS, PROTEINS, AND NUCLEIC ACIDS. AN INTRODUCTION TO ENZYME KINETICS, CELL MEMBRANE STRUCTURE AND BIOCHEMICAL SIGNALING. LABORATORY EXERCISES DEMONSTRATE THE BASIC PRINCIPLES AND TECHNIQUES USED IN BIOCHEMISTRY. THIS COURSE IS TYPICALLY OFFERED IN FALL, SPRING AND SUMMER.
Prerequisite: CHEM 3412 and (BIOL 1406 and 1407).
Co-requisite: SMTE 0093.

CHEM 4402 Biochemistry II
4 Semester Credit Hours (4 Lecture Hours)
A CONTINUATION OF CHEM 4401. BIOCHEMICAL ENERGETICS, INCLUDING GLYCOLYSIS, FATTY ACID OXIDATION, AMINO ACID OXIDATION, CITRIC ACID CYCLE, OXIDATIVE PHOSPHORYLATION, PHOTOPHOSPHORYLATION AND PHOTOSYNTHESIS. CARBOHYDRATE, FATTY ACID AND AMINO ACID BIOSYNTHESIS. LABORATORY IS A CONTINUATION OF BIOCHEMICAL TECHNIQUES. THIS COURSE IS TYPICALLY OFFERED IN FALL AND SPRING.
Prerequisite: CHEM 4401.
Co-requisite: SMTE 0093.

CHEM 4407 Advanced Inorganic Chemistry
4 Semester Credit Hours (3 Lecture Hours, 3 Lab Hours)
A SURVEY OF INORGANIC CHEMISTRY. THEORIES OF ATOMIC STRUCTURE, COVALENT BONDING, IONIC SOLIDS, METALLIC SOLIDS, AND COORDINATION COMPOUNDS. MODERN ACID?BASE CONCEPTS. LABORATORY INVOLVES THE SYNTHESIS OF INORGANIC COMPOUNDS.
Prerequisite: CHEM 3412.
Co-requisite: SMTE 0093.

CHEM 4420 Physical Biochemistry
4 Semester Credit Hours (4 Lecture Hours)
A FUNDAMENTAL APPROACH TO THE STUDY OF PHYSICAL AND CHEMICAL PHENOMENA, INCLUDING THE STUDY OF THERMODYNAMICS, GASES AND PHASE EQUILIBRIA. THIS COURSE IS TYPICALLY OFFERED ON AN IRREGULAR BASIS.
Prerequisite: CHEM 1412 and (PHYS 1402 or 2426) and MATH 2414.
Co-requisite: SMTE 0093.

CHEM 4423 Physical Chemistry I
4 Semester Credit Hours (4 Lecture Hours)
A FUNDAMENTAL APPROACH TO THE STUDY OF PHYSICAL AND CHEMICAL PHENOMENA, INCLUDING THE STUDY OF THERMODYNAMICS, GASES AND PHASE EQUILIBRIA. THIS COURSE IS TYPICALLY OFFERED IN FALL.
Prerequisite: CHEM 1412 and (PHYS 1402 or 2426) and MATH 2414.
Co-requisite: SMTE 0093.

CHEM 4424 Physical Chemistry II
4 Semester Credit Hours (4 Lecture Hours)
A CONTINUATION OF CHEM 4423, INCLUDING THE STUDY OF CHEMICAL KINETICS, ELECTROCHEMISTRY, MOLECULAR STRUCTURE, AND QUANTUM MECHANICS. THIS COURSE IS TYPICALLY OFFERED IN SPRING.
Prerequisite: CHEM 4423.
Co-requisite: SMTE 0093.

CHEM 4443 Environmental Chemistry
4 Semester Credit Hours (4 Lecture Hours)
A STUDY OF THE IMPACT OF CHEMISTRY ON THE ENVIRONMENT, INCLUDING TOPICS OF AIR POLLUTION, WATER POLLUTION, AND BENEFICIAL CHEMICAL MODIFICATIONS OF THE ENVIRONMENT. LABORATORY DEVOTED TO FIELD TECHNIQUES OF SAMPLING, SAMPLE PRESERVATION, AND ANALYTICAL TECHNIQUES APPLIED TO THE ENVIRONMENT. THIS COURSE IS TYPICALLY OFFERED IN SPRING.
Prerequisite: CHEM 1412 and 3411.
Co-requisite: SMTE 0093.

CHEM 4490 Special Topics
4 Semester Credit Hours (1-4 Lecture Hours)
MAY BE REPEATED FOR CREDIT. SUBJECT MATERIALS VARIABLE.
CHEM 4696 Directed Independent Study
1-6 Semester Credit Hours
REQUIRES A FORMAL PROPOSAL OF STUDY TO BE COMPLETED IN
ADVANCE OF REGISTRATION, TO BE APPROVED BY THE SUPERVISING
FACULTY, THE CHAIRPERSON AND THE DEAN OF THE COLLEGE.