

CHEMISTRY

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Faculty research includes studies in spectroscopic and chromatographic characterization of natural products, material science, chemical aspects of art materials, and environmental and forensic issues.

Modern instrumentation available in the department includes a 400 MHz NMR, LC-MS, laser Raman spectroscopy, FTIR, AAS, IC, x-ray diffractometer, HPLC, GC-MS and capillary electrophoresis.

Each year the Chemistry Department sponsors the Hudson Bergen Chemical Society meeting and National Chemistry Week activities. In addition, the Department also sponsors an active Chemistry Club and Student Affiliate of the American Chemical Society. The Chemistry Club offers students opportunities to share their research projects.

The Chemistry Department offers more than one degree track. Requirements for admission, fields of employment, continued areas of education, and course requirements for each of these are explained in detail below. The requirements for graduation, which precede a student's major, are listed on page 45—"Undergraduate Requirements."

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Bachelor of Science in Chemistry

Completion of this major prepares one for a career as a quality control chemist, research chemist, process development chemist, forensic/toxicology scientist, or environmental scientist. Continued study may include a master's degree and doctorate in such areas of study as chemistry/biochemistry, medicine and/or dentistry, pharmacy/pharmaceutical.

There are no requirements for ad-

mission to this degree track but students are encouraged to begin taking science and math courses as early as possible in their academic careers.

Course requirements for the completion of major are listed below. Course codes with an asterisk (*) have prerequisite or corequisite courses. These pre- and corequisites are listed with the course descriptions that follow.

| Course Code | Course Title | Credits |
|--|--|---------|
| CHEM 105* | General Chemistry I (Lecture) | 3 |
| CHEM 1105* | General Chemistry I (Recitation/Lab) | 2 |
| CHEM 106* | General Chemistry II (Lecture) | 3 |
| CHEM 1106* | General Chemistry II (Recitation/Lab) | 2 |
| CHEM 205* | Analytical Chemistry (Lecture) | 3 |
| CHEM 2205* | Analytical Chemistry (Lab) | 2 |
| CHEM 207* | Organic Chemistry I | 4 |
| CHEM 208* | Organic Chemistry II | 4 |
| CHEM 316* | Instrumental Analysis (Lecture) | 3 |
| CHEM 3316* | Instrumental Analysis (Lab) | 2 |
| CHEM 305* | Physical Chemistry I (Lecture) | 3 |
| CHEM 3305* | Physical Chemistry I (Recitation/Lab) | 2 |
| CHEM 306* | Physical Chemistry II (Lecture) | 3 |
| CHEM 3306* | Physical Chemistry II (Recitation/Lab) | 2 |
| CHEM 405 | Seminar | 1 |
| MATH 192* | Calculus and Analytic Geometry I (recommended) OR Calculus I* | 4 3 |
| MATH 193* | Calculus and Analytic Geometry II (recommended) OR Calculus II* | 4 3 |
| MATH 292* | Calculus and Analytic Geometry III* (recommended) OR Calculus III* | 4 3 |
| MATH 311* | Differential Equations for Engineering (recommended) OR Differential Equations* | 4 3 |
| INTD 180 | Computer Tools for Science and Math | 3 |
| Either set of the following two sets of four courses: | | |
| Set One (recommended): | | |
| PHYS 140* | Physics for Engineering I (Lecture) | 3 |
| PHYS 1140* | Physics for Engineering I (Recitation & Lab) | 1 |
| PHYS 141* | Physics for Engineering II (Lecture) | 3 |
| PHYS 1141* | Physics for Engineering II (Recitation & Lab) | 1 |
| Set Two: | | |
| PHYS 130* | College Physics I (Lecture) | 3 |
| PHYS 1130* | College Physics I (Recitation and Lab) | 1 |
| PHYS 131* | College Physics II (Lecture) | 3 |
| PHYS 1131* | College Physics II (Recitation and Lab) | 1 |
| Restricted elective (select one course from the following) | | |
| CHEM 307* | Biochemistry | 4 |
| CHEM 406* | Polymer Chemistry | 4 |
| CHEM 414* | Advanced Organic Chemistry | 4 |
| CHEM 416* | Advanced Inorganic Chemistry | 4 |
| CHEM 431* | Industrial Aspects of Chemistry | 3 |

Bachelor of Science in Chemistry—Teacher Certification (Physical Science)

Completion of this major and New Jersey teacher certification prepares one for a career as a physical science teacher in elementary, middle, or high schools in which science is taught as a separate subject. Continued study may include a master's degree in education, geology or earth science.

Admission to the education certification program requires a minimum cumulative grade point average (CGPA) of 2.75. Eligibility for teacher certification

by the New Jersey Department of Education is dependent upon completion of the curriculum requirements of a certification program, a passing score on the Praxis exam, and whatever minimum cumulative grade point average has been put into effect by the State at the time a graduate's application for certification arrives at the New Jersey Department of Education. Students who are interested in teacher certification as a physical science teacher must contact

the College of Education for additional requirements necessary for admission and completion of education certification program.

Course requirements for the completion of major are listed below. Course codes with an asterisk (*) have prerequisite or corequisite courses. These prerequisites and corequisites are listed with the course descriptions that follow.

| Course Code | Course Title | Credits | Either set of the following two sets of four courses | |
|--|--|---------|--|--|
| BIOL 100+ | General Biology | 3 | Set One (recommended): | |
| BIOL 130 | Principles of Biology I and | 4 | PHYS 140* | Physics for Engineering I (Lecture) 3 |
| BIOL 131 | Principles of Biology II | 4 | PHYS 1140* | Physics for Engineering I (Recitation & Lab) 1 |
| BIOL 103 | Human Sexual Biology or | 3 | PHYS 141* | Physics for Engineering II (Lecture) 3 |
| BIOL 104 | The Human Body | 3 | PHYS 1141* | Physics for Engineering II (Recitation & Lab) 1 |
| GEOS 111+ | Principles of Earth Science | 3 | Set Two: | |
| INTD 149 | Human and Intercultural Relations | 3 | PHYS 130* | College Physics I (Lecture) 3 |
| PSYC 152+ | Adolescence to Adulthood | 3 | PHYS 1130* | College Physics I (Recitation and Lab) 1 |
| SOCI 114+ | Sociology of the Family | 3 | PHYS 131* | College Physics II (Lecture) 3 |
| +This course may be used to simultaneously meet a General Studies area requirement-see p. 44-"Undergraduate Requirements." | | | PHYS 1131* | College Physics II (Recitation and Lab) 1 |
| Required | | | To be Taken in Sequence: | |
| CHEM 105* | General Chemistry I (Lecture) | 3 | EDU 250* | The Education Challenge 3 |
| CHEM 1105* | General Chemistry I (Recitation/Lab) | 2 | LTED 330* | Focus: Reading, Language and Literacy 3 |
| CHEM 106* | General Chemistry II (Lecture) | 3 | EDU 330* | Focus: Development, Behavior and Learning 3 |
| CHEM 1106* | General Chemistry II (Recitation/Lab) | 2 | EDU 331* | Education and Field Experience II 1 |
| CHEM 205* | Analytical Chemistry (Lecture) | 3 | Required Offered Fall Semesters Only (taken concurrently): | |
| CHEM 2205* | Analytical Chemistry (Lab) | 2 | LTED 370* | Secondary Reading and Language Workshop 2 |
| CHEM 207* | Organic Chemistry I | 4 | EDU 371* | Secondary Curriculum, Methods and Materials Workshop 4 |
| CHEM 208* | Organic Chemistry II | 4 | EDU 3372* | Secondary Methods of Teaching Science 2 |
| CHEM 316* | Instrumental Analysis (Lecture) | 3 | Required (taken concurrently): | |
| CHEM 3316* | Instrumental Analysis (Lab) | 2 | EDU 450* | Classroom Management Workshop 1 |
| CHEM 305* | Physical Chemistry I (Lecture) | 3 | EDU 470* | Concurrent Student Teaching Seminar 2 |
| CHEM 3305* | Physical Chemistry I (Recitation/Lab) | 2 | LTED470* | Concurrent Language Arts Seminar 1 |
| CHEM 306* | Physical Chemistry II (Lecture) | 3 | EDU 480* | Internship 8 |
| CHEM 3306* | Physical Chemistry II (Recitation/Lab) | 2 | | |
| CHEM 307* | Biochemistry | 4 | | |
| CHEM 405 | Seminar | 1 | | |
| MATH 192* | Calculus and Analytic Geometry I (recommended) | 4 | | |
| | OR Calculus I* | 3 | | |
| MATH 193* | Calculus and Analytic Geometry II (recommended) | 4 | | |
| | OR Calculus II* | 3 | | |
| MATH 292* | Calculus and Analytic Geometry III (recommended) | 4 | | |
| | OR Calculus III* | 3 | | |
| MATH 311* | Differential Equations for Engineering (recommended) | 4 | | |
| | OR Differential Equations* | 3 | | |
| INTD 180 | Computer Tools for Science and Math | 3 | | |

Minor in Chemistry

Students minor in chemistry by completing the following requirements.

| Course Code | Course Title | Credits |
|---|---|---------|
| CHEM 105* | General Chemistry I, Lecture | 3 |
| CHEM 1105* | General Chemistry I, Recitation/ Laboratory | 2 |
| CHEM 106* | General Chemistry II, Lecture | 3 |
| CHEM 1106* | General Chemistry II, Recitation/ Laboratory | 2 |
| CHEM 205* | Analytical Chemistry, Lecture | 3 |
| CHEM 2205* | Analytical Chemistry, Laboratory | 2 |
| CHEM 207* | Organic Chemistry I | 4 |
| CHEM 208* | Organic Chemistry II | 4 |
| Select one additional course in Chemistry | | 3-5 |

Course Descriptions

CHEM 100 Preparation for General Chemistry (3)

This lecture course, or a passing grade on a pre-test, is required before taking Chemistry 105. Measurement, exponential notation, problem solving, graphing and basic chemistry concepts are discussed. Credits are not included as part of major or minor.

Pre- or corequisite: MATH 112 Intermediate Algebra

CHEM 105 General Chemistry I, Lecture (3)

This course provides a qualitative and quantitative description of atomic and molecular structure, gas laws, stoichiometry, thermodynamics, and solution chemistry. This course meets the requirements for students majoring in biological or physical sciences.

Prerequisite: CHEM 100 Preparation for General Chemistry

Corequisite: CHEM 1105 General Chemistry I, Recitation/Laboratory
CHEM 1105 General Chemistry I, Recitation/Laboratory (2)

Taken concurrently with Chemistry 105, this course provides experiences which allow the students to discover the empirical relationships which support the theoretical aspects of General Chemistry I.

Corequisite: CHEM 105 General Chemistry I, Lecture

CHEM 106 General Chemistry II, Lecture (3)

This course is a continuation of Chemistry 105. Topics discussed include equilibrium, acids and bases, precipitation reactions, kinetics, and electrochemistry.

Prerequisite: CHEM 105 General Chemistry I, Lecture

Corequisite: CHEM 1106 General Chemistry II, Recitation/Laboratory

CHEM 1106 General Chemistry II, Recitation/Laboratory (2)

A continuation of Chemistry 1105, the course includes titrations, spectrophotometric work, the use of pH meters, and qualitative analysis. It is taken concurrently with Chemistry 106.

Corequisite: CHEM 106 General Chemistry II, Lecture

CHEM 111 Chemistry and Crime Detection (3)

Scientific concepts important to forensics are taught in this course, with an emphasis on chemical theories. The work includes discussions and laboratory exercises on collecting and examining physical evidence.

CHEM 112 Examination of Criminal Evidence (3)

This course includes the examination of hair, fibers, and paints. Several means of examining drugs are covered. The examination of evidence includes toxicological and serological materials. Death investigation and rape evidence are discussed. Arson, firearms, and evidence from explosions are also covered.

CHEM 117 Principles of Chemistry, Lecture (3)

This course includes basic principles of inorganic, organic and biochemistry. It is designed to meet the needs of students in nursing or allied health and science educators.

Corequisite: CHEM 1117 Principles of Chemistry, Laboratory

CHEM 117 Principles of Chemistry, Laboratory (1)

Laboratory work to accompany CHEM 117.

Corequisite: CHEM 117 Principles of Chemistry, Lecture

CHEM 205 Analytical Chemistry, Lecture (3)

Precipitation reactions, acid-base phenomenon, spectral and chromato-

graphic analysis, complex formation, and electrochemistry are discussed. The use of statistics in analytical chemistry is also covered.

Prerequisites: CHEM 106 General Chemistry II (Lecture), CHEM 1106 General Chemistry II (Recitation/Laboratory)

Corequisite: CHEM 2205 Analytical Chemistry, Laboratory

CHEM 2205 Analytical Chemistry, Laboratory (2)

This course, taken with Chemistry 205, includes gravimetric, volumetric, spectrophotometric, chromatographic, and potentiometric techniques.

Corequisite: CHEM 205 Analytical Chemistry, Lecture

CHEM 207 Organic Chemistry I (4)

This is a lecture-laboratory course covering the preparation, properties, structure and uses of carbon compounds. Hydrocarbons of all types and their halogen derivatives are studied. The laboratory experiments utilizing modern instrumentation are integrated with the lecture material.

Prerequisites: CHEM 106 General Chemistry II, Lecture; CHEM 1106 General Chemistry II, Recitation/Laboratory

CHEM 208 Organic Chemistry II (4)

A continuation of CHEM 207 Organic Chemistry I, this course covers aromatics, alcohols, ethers, carbonyl compounds, and other functional classes. Laboratory work parallels the lecture material.

Prerequisite: CHEM 207 Organic Chemistry I

CHEM 305 Physical Chemistry I, Lecture (3)

Elementary aspects of thermodynamics with applications to gases, liquids, crystals, chemical equilibria, solutions, and electrochemistry are taught in this course.

Prerequisites: CHEM 205 Analytical Chemistry, Lecture; MATH 311 Differential Equations for Engineers or MATH 310 Differential Equations; PHYS 141 Physics for Engineering II, Lecture; and PHYS 1141 Physics for Engineering II, Recitation/Laboratory or PHYS 131 College Physics II, Lecture and PHYS 1131 College Physics II, Recitation/Laboratory

CHEM 3305 Physical Chemistry I, Recitation/Laboratory (2)

This course looks at experimental determination of molecular and equilibrium properties of pure substances and solutions. The operation and calibration

of instruments are considered. Recitation problem-solving is stressed.

Corequisite: CHEM 305 Physical Chemistry I, Lecture

CHEM 306 Physical Chemistry II, Lecture (3)

This course emphasizes microscopic properties, kinetic theory of gases, statistical mechanics, elementary quantum chemistry, and spectroscopic methods of molecular structure determination.

Prerequisite: CHEM 305 Physical Chemistry I, Lecture

Corequisite: CHEM 3306 Physical Chemistry II, Recitation/Laboratory
CHEM 3306 Physical Chemistry II, Recitation/Laboratory (2)

A continuation of Chemistry 3305, the course emphasizes electrochemistry, calorimetry, and the kinetic properties of reactive systems. Recitation problem-solving is stressed.

Corequisite: CHEM 306 Physical Chemistry II, Lecture

CHEM 307 Biochemistry I (4)

This course presents the structure and properties of proteins, fats, carbohydrates, nucleic acids, vitamins, and enzymes. Laboratory work includes methods for the identification of biological compounds.

Prerequisite: CHEM 208 Organic Chemistry II

CHEM 308 Biochemistry II (4)

This course discusses the metabolism of carbohydrates, fats, and proteins. Photosynthesis, nitrogen fixation, cell regulation, regulatory genes, and hormones are also described. Laboratory work includes the isolation and analysis of cell constituents.

Prerequisites: CHEM 307 Biochemistry I

CHEM 316 Instrumental Analysis, Lecture (3)

Theories of ultraviolet, visible and infrared spectroscopy, gas and liquid chromatography, mass spectrometry, and NMR analyses are presented in this course.

Prerequisites: CHEM 205 Analytical Chemistry, Lecture; CHEM 2205 Analytical Chemistry, Laboratory

Corequisite: CHEM 3316 Instrumental Analysis, Laboratory

CHEM 3316 Instrumental Analysis, Laboratory (2)

This course gives students practical experience in the use of modern instruments including ultraviolet, infrared, atomic absorption, nuclear magnetic resonance and mass spectroscopy, gas and liquid chromatography, and electrochemistry.

Corequisite: CHEM 316 Instrumental Analysis (lecture)

CHEM 405 Seminar (1)

In this course students prepare a detailed presentation based on the chemical literature and independent research. Research results are presented to chemistry faculty and students at an end-of-year science symposium.

Prerequisite: CHEM 208 Organic Chemistry II

CHEM 406 Polymer Chemistry (4)

This course is a study of the organic and physical chemistry of high polymers, including methods of preparation, chemical and physical properties, and structure-property relationships.

Prerequisites: CHEM 208 Organic Chemistry II, CHEM 305 Physical Chemistry I, Lecture

CHEM 414 Advanced Organic Chemistry (4)

This course covers topics including stereochemistry and conformational analysis, free radicals, molecular rearrangements, and reaction mechanisms. Laboratory work includes selected studies in procedures of synthesis and instrumental techniques for the identification of synthesized materials.

Prerequisites: CHEM 208 Organic Chemistry II, CHEM 316 Instrumental Analysis, Lecture; and CHEM 3316 Instrumental Analysis, Laboratory

CHEM 416 Advanced Inorganic Chemistry (3)

Selected topics from inorganic chemistry at an advanced level are presented in this course. The stereochemistry, kinetics, and mechanisms of inorganic reactions are emphasized.

Prerequisites: CHEM 305 Physical Chemistry I, Lecture

CHEM 431 Industrial Aspects of Chemistry (3)

This course is a study of the process for making industrial chemicals and the influences of energy, environment and safety regulations on industry. Rudiments of chemical engineering and business and economic practices which govern the management of chemical and pharmaceutical industries are discussed.

Prerequisites: CHEM 208 Organic Chemistry II

CHEM 492 Independent Study in Natural Science (1)

Chemistry majors are encouraged to undertake independent laboratory-oriented projects. These courses do not replace other chemistry requirements.

CHEM 1492 Independent Study in Natural Science (2)

Chemistry majors are encouraged to undertake independent laboratory-oriented projects. These courses do not replace other chemistry requirements.

CHEM 2492 Independent Study in Natural Science (3)

Chemistry majors are encouraged to undertake independent laboratory-oriented projects. These courses do not replace other chemistry requirements.