Chemistry

Chemistry is often called the "Central Science," because chemical knowledge is essential not only to chemists, but also to biologists (through biochemistry, molecular biology, and environmental chemistry) and engineers (through materials science and polymers). A good knowledge of chemistry provides many options for graduate study and many options for career paths.

The study of chemistry can be divided into two parts: analysis and synthesis. Analysis determines the identities of the components of a real-world sample (a sample of polluted water, for example) and then measures how much of each component is present. Synthesis produces new, previously non-existent materials. Twenty-one million chemicals are known, and new ones are produced all the time. Will you synthesize one that reduces pollution? Cures a dreaded disease?

First-and second-year students interested in a chemistry major or minor are encouraged to discuss their career interests with members of the Department of Chemistry. This will allow good schedule planning, leading to on-time graduation.

Programs

- Chemistry, B.A. *major*
- Chemistry, B.S. (Chemistry Emphasis) *major*
- Chemistry, B.S. (Biochemistry/ Biotechnology Emphasis) *major*
- Chemistry, B.S. (Environmental Chemistry Emphasis) *major*
- Chemistry, B.S. (Criminalistics Emphasis) *major*
- Science Education, B.S. (Chemistry Specialty (Teacher Licensure)) *major*
- Chemistry *minor*

Career Directions

Biologist
Chemist
Dentist
Engineer
Entrepreneur
Environmental Chemist
Forensic Scientist
Geochemist
Nutritionist
Optometrist
Pharmacist
Physical Therapist
Physician
Technical Management
Technical Sales
Toxicologist
Veterinarian
Also: Graduate Study

Preparation

Recommended High School Courses

Biology
Chemistry
Mathematics
Physics

Chemistry, B.A. *major*

Required Credits: 31
Required GPA: 2.25

I REQUIRED COURSES

Note: Students enrolled in CHEM 1111 who elect this major should enroll in CHEM 2212 during the second semester.

SELECT 1 OF THE FOLLOWING COURSES:

- CHEM 1111 General Chemistry I (4 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)

COMPLETE THE FOLLOWING COURSES:

- CHEM 2212 Principles of Chemistry II (4 credits)
- CHEM 3100 Journal Club (1 credit)
- CHEM 3110 Laboratory Management and Safety (2 credits)
- CHEM 3311 Organic Chemistry I (3 credits)
- CHEM 3312 Organic Chemistry II (3 credits)
- CHEM 3371 Organic Chemistry Laboratory I (1 credit)
- CHEM 3372 Organic Chemistry Laboratory II (1 credit)
- CHEM 3507 Analytical Chemistry (3 credits)
- CHEM 3570 Analytical Chemistry Laboratory (1 credit)

SELECT 1 OF THE FOLLOWING COURSES:

- CHEM 4411 Biochemistry I (3 credits)
- CHEM 4811 Advanced Inorganic Chemistry I (3 credits)

II REQUIRED ELECTIVES

SELECT 5 SEMESTER CREDITS OF ELECTIVES FROM CHEM 3100 OR ABOVE. UP TO 4 SEMESTER CREDITS OF RESEARCH CHEM 3980 OR CHEM 4980 MAY BE USED IN THIS AREA.

SUGGESTED SEMESTER SCHEDULE FOR CHEMISTRY MAJOR, B.A.

The following is a list of required courses for the Chemistry Major, B.A., arranged by year. This schedule is intended to assist students in planning their academic program and may be altered somewhat to fit the students background and circumstances.

Freshman

- CHEM 2211 Principles of Chemistry I (4 credits)
- CHEM 2212 Principles of Chemistry II (4 credits)
- Liberal Education requirements
- Electives

Sophomore

- CHEM 3311 Organic Chemistry I (3 credits)
- CHEM 3312 Organic Chemistry II (3 credits)
- CHEM 3371 Organic Chemistry Laboratory I (1 credit)
- CHEM 3372 Organic Chemistry Laboratory II (1 credit)

- CHEM 3507 Analytical Chemistry (3 credits)
- CHEM 3570 Analytical Chemistry Laboratory (1 credit)
- Liberal Education requirements

Junior/Senior

- CHEM 3100 Journal Club (1 credit)
- CHEM 3110 Laboratory Management and Safety (2 credits)
- CHEM 4411 Biochemistry I (3 credits)
  or CHEM 4811 Advanced Inorganic Chemistry I (3 credits)
- Chemistry electives
- Complete Liberal Education requirements
- Electives

Chemistry, B.S. *major*
Chemistry Emphasis

Required Credits: 73
Required GPA: 2.25

I REQUIRED COURSES

SELECT 1 OF THE FOLLOWING COURSES:

- CHEM 1111 General Chemistry I (4 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)

COMPLETE THE FOLLOWING COURSES:

- CHEM 2212 Principles of Chemistry II (4 credits)
- CHEM 3100 Journal Club (1 credit)
- CHEM 3311 Organic Chemistry I (3 credits)
- CHEM 3312 Organic Chemistry II (3 credits)
- CHEM 3371 Organic Chemistry Laboratory I (1 credit)
- CHEM 3372 Organic Chemistry Laboratory II (1 credit)
- CHEM 3507 Analytical Chemistry (3 credits)
- CHEM 3570 Analytical Chemistry Laboratory (1 credit)
- CHEM 4510 Instrumental Methods of Analysis (3 credits)
- CHEM 4571 Instrumental Analysis Laboratory I (1 credit)
- CHEM 4572 Instrumental Analysis Laboratory II (1 credit)
- MATH 2471 Calculus I (5 credits)
- PHYS 2101 Physics I (5 credits)

II REQUIRED EMPHASIS

COMPLETE THE FOLLOWING COURSES:

- CHEM 4411 Biochemistry I (3 credits)
- CHEM 4711 Physical Chemistry I (3 credits)
- CHEM 4712 Physical Chemistry II (3 credits)
- CHEM 4771 Physical Chemistry Laboratory I (1 credit)
- CHEM 4772 Physical Chemistry Laboratory II (1 credit)
- CHEM 4811 Advanced Inorganic Chemistry I (3 credits)
- CHEM 4871 Inorganic Chemistry Laboratory I (1 credit)
- MATH 2472 Calculus II (5 credits)
- PHYS 2102 Physics II (5 credits)

SELECT 1 OF THE FOLLOWING COURSES:

- CHEM 4412 Biochemistry II (3 credits)
- CHEM 4812 Advanced Inorganic Chemistry II (3 credits)

II REQUIRED EMPHASIS

SELECT 9 SEMESTER CREDITS FROM CHEM 3100 OR ABOVE AND/OR THE FOLLOWING COURSES. (7 CREDITS MUST COME FROM 3000-LEVEL COURSES OR ABOVE). CHEM 3100 MAY BE REPEATED WITH 1 SEMESTER CREDIT APPLYING TO THIS AREA.

- PHYS 3300 Thermodynamics and Heat Transfer (3 credits)
- PHYS 3600 Modern Physics (4 credits)

- MATH 2210 Discrete Mathematics (4 credits)
- MATH 2480 Multivariable Calculus (4 credits)
- MATH 2490 Differential Equations (4 credits)
- STAT 2610 Applied Statistics (4 credits)

Chemistry, B.S. *major*
Biochemistry/ Biotechnology Emphasis

Required Credits: 66
Required GPA: 2.25

I REQUIRED COURSES

SELECT 1 OF THE FOLLOWING COURSES:

- CHEM 1111 General Chemistry I (4 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)

COMPLETE THE FOLLOWING COURSES:

- CHEM 2212 Principles of Chemistry II (4 credits)
- CHEM 3100 Journal Club (1 credit)
- CHEM 3311 Organic Chemistry I (3 credits)
- CHEM 3312 Organic Chemistry II (3 credits)
- CHEM 3371 Organic Chemistry Laboratory I (1 credit)
- CHEM 3372 Organic Chemistry Laboratory II (1 credit)
- CHEM 3507 Analytical Chemistry (3 credits)
- CHEM 3570 Analytical Chemistry Laboratory (1 credit)
- CHEM 4510 Instrumental Methods of Analysis (3 credits)
- CHEM 4571 Instrumental Analysis Laboratory I (1 credit)
- CHEM 4572 Instrumental Analysis Laboratory II (1 credit)
- MATH 2471 Calculus I (5 credits)
- PHYS 2101 Physics I (5 credits)

II REQUIRED EMPHASIS

COMPLETE THE FOLLOWING COURSES:

- BIOL 1211 Introductory Biology I (4 credits)
- BIOL 1212 Introductory Biology II (4 credits)
- CHEM 4411 Biochemistry I (3 credits)
- CHEM 4412 Biochemistry II (3 credits)
- CHEM 4471 Biochemistry Laboratory I (1 credit)
- CHEM 4472 Biochemistry Laboratory II (1 credit)

SELECT 2 OF THE FOLLOWING COURSES:

- BIOL 2110 Human Anatomy and Physiology (5 credits)
- BIOL 2360 Genetics (4 credits)
- BIOL 3580 Immunology (4 credits)
- BIOL 3590 Cell Biology (4 credits)
- BIOL 3710 Microbiology (4 credits)

II REQUIRED EMPHASIS

Select 6 semester credits from CHEM 3100 or above. Up to 3 semester credits of research (CHEM 3980 or 4980) and internship (CHEM 3970 or 4970) may be used in this area. CHEM 3100 may be repeated with 1 credit applying to this area.

SUGGESTED SEMESTER SCHEDULE FOR CHEMISTRY MAJOR, B.A.

The following is a list of required courses for the Chemistry Major, B.A., arranged by year. This schedule is intended to assist students in planning their academic program and may be altered somewhat to fit the students background and circumstances.

Freshman

- CHEM 2211 Principles of Chemistry I (4 credits)
- CHEM 2212 Principles of Chemistry II (4 credits)
- Liberal Education requirements
- Electives

Sophomore

- CHEM 3311 Organic Chemistry I (3 credits)
- CHEM 3312 Organic Chemistry II (3 credits)
- CHEM 3371 Organic Chemistry Laboratory I (1 credit)
- CHEM 3372 Organic Chemistry Laboratory II (1 credit)
- CHEM 3507 Analytical Chemistry (3 credits)
- CHEM 3570 Analytical Chemistry Laboratory (1 credit)
- Liberal Education requirements

Junior/Senior

- CHEM 3100 Journal Club (1 credit)
- CHEM 3110 Laboratory Management and Safety (2 credits)
- CHEM 4411 Biochemistry I (3 credits)
  or CHEM 4811 Advanced Inorganic Chemistry I (3 credits)
- Chemistry electives
- Complete Liberal Education requirements
- Electives

Chemistry, B.S. *major*
Environmental Chemistry Emphasis

Required Credits: 70
Required GPA: 2.25

I REQUIRED COURSES

SELECT 1 OF THE FOLLOWING COURSES:

- CHEM 1111 General Chemistry I (4 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)

COMPLETE THE FOLLOWING COURSES:

- CHEM 2212 Principles of Chemistry II (4 credits)
- CHEM 3100 Journal Club (1 credit)
- CHEM 3311 Organic Chemistry I (3 credits)
- CHEM 3312 Organic Chemistry II (3 credits)
- CHEM 3371 Organic Chemistry Laboratory I (1 credit)
- CHEM 3372 Organic Chemistry Laboratory II (1 credit)
- CHEM 3507 Analytical Chemistry (3 credits)
- CHEM 3570 Analytical Chemistry Laboratory (1 credit)
- CHEM 4510 Instrumental Methods of Analysis (3 credits)
- CHEM 4571 Instrumental Analysis Laboratory I (1 credit)
- CHEM 4572 Instrumental Analysis Laboratory II (1 credit)
- MATH 2471 Calculus I (5 credits)
- PHYS 2101 Physics I (5 credits)

II REQUIRED EMPHASIS

COMPLETE THE FOLLOWING COURSE:

- CHEM 4110 Environmental Chemistry (3 credits)
  or ENVR 4110 Environmental Chemistry (3 credits)

COMPLETE 4 SEMESTER CREDITS FROM THE FOLLOWING COURSE:

- CHEM 4970 Internship (3-4 credits)

II REQUIRED EMPHASIS

Select 3 semester credits of electives from CHEM 3100 or above. (CHEM 3100 may be repeated with 1 credit applying to this area.)

SELECT 24 SEMESTER CREDITS FROM THE FOLLOWING COURSES:

- BIOL 2610 General Ecology (3 credits)
- BIOL 3361 Limnology (4 credits)
- CHEM 3140 Chemical Toxicology (3 credits)
- CHEM 3150 Standard Methods of Water Analysis (3 credits)
  *or*ENVR 4220 Sampling and Analysis (4 credits)
- CHEM 4411 Biochemistry I (3 credits)
- CHEM 4412 Biochemistry II (3 credits)
- CHEM 4471 Biochemistry Laboratory I (1 credit)
- ENVR 4050 Geochemistry (3 credits)
- ENVR 4200 Wastewater Treatment (3 credits)
- ENVR 4240 Waste Management (4 credits)
- ENVR 4260 Risk Assessment and Auditing (3 credits)
- ENVR 4400 Environmental Microbiology (3 credits)
- ENVR 4500 Environmental Toxicology (4 credits)
- GEOL 3211 Environmental Hydrology (3 credits)

Chemistry, B.S. *major*
Criminalistics Emphasis

Required Credits: 75
Required GPA: 2.25

I REQUIRED COURSES

SELECT 1 OF THE FOLLOWING COURSES:

- CHEM 1111 General Chemistry I (4 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)

COMPLETE THE FOLLOWING COURSES:

- CHEM 2212 Principles of Chemistry II (4 credits)
- CHEM 3100 Journal Club (1 credit)
- CHEM 3311 Organic Chemistry I (3 credits)
- CHEM 3312 Organic Chemistry II (3 credits)

- CHEM 3371 Organic Chemistry Laboratory I (1 credit)
- CHEM 3372 Organic Chemistry Laboratory II (1 credit)
- CHEM 3507 Analytical Chemistry (3 credits)
- CHEM 3570 Analytical Chemistry Laboratory (1 credit)
- CHEM 4510 Instrumental Methods of Analysis (3 credits)
- CHEM 4571 Instrumental Analysis Laboratory I (1 credit)
- CHEM 4572 Instrumental Analysis Laboratory II (1 credit)
- MATH 2471 Calculus I (5 credits)
- PHYS 2101 Physics I (5 credits)

II REQUIRED EMPHASIS

COMPLETE THE FOLLOWING COURSES:

- BIOL 1211 Introductory Biology I (4 credits)
- BIOL 1212 Introductory Biology II (4 credits)
- BIOL 3380 Molecular Genetics: Theory and Practice (4 credits)
- CHEM 2210 Criminalistics (3 credits)
- CHEM 2270 Criminalistics Laboratory (1 credit)
- CHEM 4411 Biochemistry I (3 credits)
- CHEM 4471 Biochemistry Laboratory I (1 credit)
- CRJS 1120 Criminal Justice and Society (3 credits)
- CRJS 3358 Criminal Law (3 credits)
- CRJS 3359 Criminal Investigation (3 credits)
- STAT 2610 Applied Statistics (4 credits)

COMPLETE THE FOLLOWING COURSE FOR 3 CREDITS:

- CHEM 4970 Internship (3-4 credits)

SELECT 1 OF THE FOLLOWING COURSES:

- CHEM 4711 Physical Chemistry I (3 credits)
- CHEM 4712 Physical Chemistry II (3 credits)

Science Education, B.S. *major*
Chemistry Specialty (Teacher Licensure)

Required Credits: 78
Required GPA: 2.50

Core Courses for Science Teaching in Grades 5-8

COMPLETE THE FOLLOWING COURSES:

- BIOL 1211 Introductory Biology I (4 credits)
  or BIOL 1110 Human Biology (4 credits)
- BIOL 1212 Introductory Biology II (4 credits)
  or BIOL 1120 General Biology: Evolution And Ecology (3 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)
  or CHEM 1111 General Chemistry I (4 credits)
- CHEM 2212 Principles of Chemistry II (4 credits)
  or CHEM 1112 General Chemistry II (4 credits)
- GEOL 1110 Physical Geology (4 credits)
- SCI 3100 Integrative Science for Teachers (4 credits)
- SCI 3450 Science Methods For Grades 5-8 (4 credits)
  or ED 3410 Middle School Science Methods (4 credits)

REQUIRED PROFESSIONAL EDUCATION COURSES

COMPLETE THE FOLLOWING COURSES:

- ED 3100 Introduction to the Foundations of Public School Education (3 credits)
- ED 3110 Educational Psychology (3 credits)
- ED 3140 Human Relations In Education (3 credits)
- ED 3350 Pedagogy: Planning for Instruction (3 credits)
- ED 3780 Adaptation and Management: Designing the Learning Environment (3 credits)
- ED 4737 Content Area Reading (3 credits)
- ED 4799 The Professional Teacher (1 credit)
- HLTH 3400 Health and Drugs in Society (2 credits)

Complete 12 credits of student teaching:

- ED 4830 Student Teaching - Secondary (1-12 credits)

CHEMISTRY SPECIALTY

COMPLETE THE FOLLOWING COURSES:

- CHEM 3110 Laboratory Management and Safety (2 credits)
- CHEM 3311 Organic Chemistry I (3 credits)
- CHEM 3312 Organic Chemistry II (3 credits)
- CHEM 3371 Organic Chemistry Laboratory I (1 credit)
- CHEM 3372 Organic Chemistry Laboratory II (1 credit)
- CHEM 3507 Analytical Chemistry (3 credits)
- CHEM 3570 Analytical Chemistry Laboratory (1 credit)
- CHEM 3980 Research (1 credit)

SELECT 1 OF THE FOLLOWING COURSES:

- CHEM 4411 Biochemistry I (3 credits)
- CHEM 4811 Advanced Inorganic Chemistry I (3 credits)

Chemistry *minor*

Required Credits: 23
Required GPA: 2.00

REQUIRED COURSES

SELECT 1 OF THE FOLLOWING COURSES:

- CHEM 1111 General Chemistry I (4 credits)
- CHEM 2211 Principles of Chemistry I (4 credits)

COMPLETE THE FOLLOWING COURSES:

- CHEM 2212 Principles of Chemistry II (4 credits)
- CHEM 3311 Organic Chemistry I (3 credits)
- CHEM 3312 Organic Chemistry II (3 credits)
- CHEM 3371 Organic Chemistry Laboratory I (1 credit)
- CHEM 3372 Organic Chemistry Laboratory II (1 credit)

REQUIRED SPECIALIZATION
Select 1 of the following specializations: A, B OR C

A. ANALYTICAL CHEMISTRY

COMPLETE THE FOLLOWING COURSES:

- CHEM 3507 Analytical Chemistry (3 credits)
- CHEM 3570 Analytical Chemistry Laboratory (1 credit)
- CHEM 4510 Instrumental Methods of Analysis (3 credits)
- CHEM 4571 Instrumental Analysis Laboratory I (1 credit)

B. BIOCHEMISTRY /BIOTECHNOLOGY

COMPLETE THE FOLLOWING COURSES:

- CHEM 4411 Biochemistry I (3 credits)
- CHEM 4412 Biochemistry II (3 credits)
- CHEM 4471 Biochemistry Laboratory I (1 credit)

C. CRIMINALISTICS

COMPLETE THE FOLLOWING COURSES:

- CHEM 2210 Criminalistics (3 credits)
- CHEM 2270 Criminalistics Laboratory (1 credit)
- CHEM 3507 Analytical Chemistry (3 credits)
- CHEM 3570 Analytical Chemistry Laboratory (1 credit)
- CRJS 1120 Criminal Justice and Society (3 credits)

Chemistry Courses

CHEM 1100 Consumer Chemistry (3 credits)
Chemistry as viewed through illustrations taken from common substances, objects, and processes in the world around us. Topics range from table salt to perception-altering drugs, and from drinking water to nuclear power. Intended for nonscience majors. Liberal Education Goal Area 3.

CHEM 1110 Chemistry for Allied Health (3 credits)
Survey of concepts in general and organic chemistry and biochemistry. Laboratory component introduces techniques, methods, and instrumentation. Intended for students majoring in Nursing and other allied health disciplines.

CHEM 1111 General Chemistry I (4 credits)
A survey of chemistry covering basic concepts including inorganic, organic, and biochemistry. The laboratory component introduces techniques, methods, and instrumentation. Liberal Education Goal Area 3 (LC). If on-campus student must register for CHEM 1111 (Lecture) and CHEM 1171 (Lab).

CHEM 1112 General Chemistry II (4 credits)
A continuation of the survey begun in chemistry 1111 covering basic concepts of inorganic, organic, and biochemistry. The laboratory component introduces techniques, methods, and instrumentation. Prerequisite: CHEM 1111 or CHEM 2211. Liberal Education Goal Area (LC).

CHEM 1921 Directed Group Study (3 credits)
Arranged group study.

CHEM 2130 Chemistry of Drugs (3 credits)
Introduction to the pharmacology of the more common drugs and toxic substances.

CHEM 2210 Criminalistics (3 credits)
Introduction to the theory and practice of physical evidence analysis. Topics include firearms, fingerprints, hairs and fibers, numbers restoration, shoeprints, arson, and paints. Prerequisites: CHEM 1111 or CHEM 2211.

CHEM 2211 Principles of Chemistry I (4 credits)
Principles of inorganic, physical, solution, and gas phase chemistry. The laboratory component introduces techniques, methods, and instrumentation. Intended for chemistry majors and minors, biology majors, preprofessional students, and open to any student meeting the prerequisites wishing to fulfill their Liberal Education requirement. Liberal Education Goal Area 3 (LC). If on-campus student must register for CHEM 2211 (Lecture) and CHEM 2271(Lab).

CHEM 2212 Principles of Chemistry II (4 credits)
Continuation of the development of principles of inorganic, physical, solution, and gas phase chemistry begun in CHEM 1211. The laboratory component introduces techniques, methods, and instrumentation. Intended for chemistry majors and minors, biology majors, preprofessional students, and open to any student meeting the prerequisites wishing to fulfill their Liberal Education requirement. Prerequisite: CHEM 1111 or CHEM 2211. Liberal Education Goal Area 3 (LC). Student must register for CHEM 2212 (Lecture) and CHEM 2272 (Lab).

CHEM 2270 Criminalistics Laboratory (1 credit)
Introduction to the analyses performed in forensic chemistry. Corequisite: CHEM 2210.

CHEM 2925 People and the Environment: Chemistry Perspective (3 credits)
A study of the chemical processes important in maintaining a clean environment. Liberal Education Goal Area 10.

CHEM 3100 Journal Club (1 credit)
Oral and written presentations of special topics in chemistry. May be repeated with 2 semester credits allowed toward chemistry major. Prerequisite: CHEM 3312.

CHEM 3110 Laboratory Management and Safety (2 credits)
Laboratory management concepts, safety information concerning chemical substances. Prerequisite: Junior or Senior standing.

CHEM 3140 Chemical Toxicology (3 credits)
Chemical principles in toxicology. Design of environmentally safer chemicals; quantitative analysis of the toxicity of various molecules. Prerequisite: CHEM 3311.

CHEM 3150 Standard Methods of Water Analysis (3 credits)
Introduction to techniques of analysis of natural and effluent water samples using standard analytical techniques. Prerequisite: CHEM 1112 or CHEM 2212.

CHEM 3210 Interpretation of Spectral Data (2 credits)
Systematic identification of chemical structures utilizing data from mass spectrometry, infrared spectroscopy, and nuclear magnetic resonance spectroscopy. Prerequisites: CHEM 3312 or CHEM 3372 (may be co-requisite).

CHEM 3311 Organic Chemistry I (3 credits)
A study of the properties of aliphatic and aromatic compounds and the theories and mechanisms to account for those properties. Prerequisite: CHEM 1112 or CHEM 2212.

CHEM 3312 Organic Chemistry II (3 credits)
Continuation of study of the properties of functional groups and the theories and mechanisms to account for those properties. Prerequisite: CHEM 3311.

CHEM 3371 Organic Chemistry Laboratory I (1 credit)
Laboratory study of the reactions of organic compounds. Prerequisites: CHEM 1112 or CHEM 2212; Corequisite CHEM 3311.

CHEM 3372 Organic Chemistry Laboratory II (1 credit)
Laboratory study of the reactions of organic compounds. Prerequisite: CHEM 3371; Corequisite CHEM 3312.

CHEM 3507 Analytical Chemistry (3 credits)
A study of equilibrium processes and the experimental methods and instruments used for quantitative analysis of samples. Prerequisite: CHEM 1112 or CHEM 2212.

CHEM 3570 Analytical Chemistry Laboratory (1 credit)
Laboratory applications of analytical instrumentation to chemical analysis. Prerequisites: CHEM 1112 or CHEM 2212, CHEM 3507 (may be corequisite).

CHEM 3970 Internship (3 credits)
Graded Satisfactory/Unsatisfactory only. Student internships may be either full-time or part-time in a public or private agency appropriate to the degree objective. Internships consist of closely supervised periods of service that are arranged in advance of the course registration. Students should consult their advisor concerning prerequisites.

CHEM 3980 Research (1 credit)
Research carried out by the student that is based on appropriate methodology and scholarship.

CHEM 4110 Environmental Chemistry (3 credits)
Intensive study of biogeochemical cycles of natural and man-made pollutants including transformations, transport, fate and persistence mechanisms. Environmental effects, long-term impacts, and methods of treatment/prevention are discussed. Prerequisites: CHEM 1112 or CHEM 2212 or consent of instructor.

CHEM 4320 Special Topics in Organic Chemistry (1-3 credits)
Selected topics such as advanced synthesis, advanced reaction mechanisms, polymers, and natural products. May be repeated when topic is changed. Prerequisite: CHEM 3312. Might not be offered every year.

CHEM 4411 Biochemistry I (3 credits)
Chemical principles governing metabolic functions and genetics. Prerequisites: CHEM 3312 or consent of instructor.

CHEM 4412 Biochemistry II (3 credits)
Continuation of CHEM 3411. Chemical principles governing metabolic functions and genetic materials. Prerequisite: CHEM 4411.

CHEM 4420 Special Topics in Biochemistry (1-3 credits)
Selected topics such as carbohydrates, lipids, proteins, enzymology, nucleic acids, metabolism, toxicology, and biochemical lab techniques. May be repeated when topic is changed. Prerequisite: CHEM 3312. Might not be offered every year.

CHEM 4471 Biochemistry Laboratory I (1 credit)
Laboratory techniques pertaining to biochemistry. Prerequisites: CHEM 3312 and CHEM 3372, Corequisite: CHEM 4411.

CHEM 4472 Biochemistry Laboratory II (1 credit)
Continuation of laboratory techniques pertaining to biochemistry. Prerequisites: CHEM 4411; Corequisite: CHEM 4412.

CHEM 4510 Instrumental Methods of Analysis (3 credits)
Theory and applications of instrumental methods of chemical analysis. Prerequisite: CHEM 3507 and CHEM 3570.

CHEM 4520 Special Topics in Analytical Chemistry (1-3 credits)
Selected topics such as mass spectrometry, NMR, electrochemistry, chemical separations, and computerized instrument interfaces. Prerequisite: CHEM 3507. Might not be offered every year.

CHEM 4571 Instrumental Analysis Laboratory I (1 credit)
Experimental applications of instrumental methods of chemical analysis. Corequisite: CHEM 4510.

CHEM 4572 Instrumental Analysis Laboratory II (1 credit)
Continuation of CHEM 4571. Experimental applications of instrumental methods of chemical analysis. Prerequisite: CHEM 4510.

CHEM 4711 Physical Chemistry I (3 credits)
Fundamental understanding of chemical and physical properties of atoms and molecules through quantum mechanical and classical approaches. Prerequisites: CHEM 2212 and PHYS 2101.

CHEM 4712 Physical Chemistry II (3 credits)
Fundamental understanding of chemical and physical properties of atoms and molecules through quantum mechanical and classical approaches. Prerequisites: CHEM 4711 or consent of instructor.

CHEM 4720 Special Topics in Physical Chemistry (1-3 credits)
Selected topics such as kinetics, thermodynamics, quantum chemistry, and molecular modeling. Prerequisite: CHEM 3312. Might not be offered every year.

CHEM 4771 Physical Chemistry Laboratory I (1 credit)
Physical chemistry laboratory applications. Prerequisites: CHEM 3570; Corequisite: CHEM 4711.

CHEM 4772 Physical Chemistry Laboratory II (1 credit)
Physical chemistry laboratory applications. Continuation of 3771. Prerequisites: CHEM 3570; Corequisite: CHEM 4712.

CHEM 4811 Advanced Inorganic Chemistry I (3 credits)
Theoretical approach to the principles of inorganic chemistry. Integration of theory and descriptive chemistry. Corequisite: CHEM 3312.

CHEM 4812 Advanced Inorganic Chemistry II (3 credits)
Continuation of the study of the theoretical approaches to the principles of inorganic chemistry. Prerequisite: CHEM 4712 and CHEM 4811.

CHEM 4820 Special Topics in Inorganic Chemistry (1-3 credits)
Selected topics such as organometallics, catalysis, bioinorganic chemistry, and materials chemistry. Prerequisite: CHEM 3312. Might not be offered every year.

CHEM 4871 Inorganic Chemistry Laboratory I (1 credit)
Laboratory oriented approach emphasizing techniques and theories of preparative inorganic chemistry. Prerequisite: CHEM 4711.

CHEM 4872 Inorganic Chemistry Laboratory II (1 credit)
Laboratory oriented approach emphasizing techniques and theories of preparative inorganic chemistry. Prerequisite: CHEM 4871.

CHEM 4970 Internship (3-4 credits)
Graded Satisfactory/Unsatisfactory only. Student internships may be either full-time or part-time in a public or private agency appropriate to the degree objective. Internships consist of closely supervised periods of service that are arranged in advance of the course registration. Students should consult their advisor concerning prerequisites.

CHEM 4980 Research (3 credits)
Research carried out by the student that is based on appropriate methodology and scholarship.

All-University Courses

The course numbers listed below, not always included in the semester class schedule, may be registered for by consent of the advisor, instructor, or department chair, or may be assigned by the department when warranted. Individual registration requires previous arrangement by the student and the completion of any required form or planning outline as well as any prerequisites.

1910, 2910, 3910, 4910 DIRECTED INDEPENDENT STUDY
1920, 2920, 3920, 4920 DIRECTED GROUP STUDY
1930, 2930, 3930, 4930 EXPERIMENTAL COURSE
1940, 2940, 3940, 4940 IN-SERVICE COURSE
1950, 2950, 3950, 4950 WORKSHOP, INSTITUTE, TOUR
1960, 2960, 3960, 4960 SPECIAL PURPOSE INSTRUCTION
1970, 2970, 3970, 4970 INTERNSHIP
1980, 2980, 3980, 4980 RESEARCH
1990, 2990, 3990, 4990 THESIS