

CHEMISTRY

The SMSU Chemistry Program offers lecture and laboratory courses in support of a variety of professional, pre-professional, liberal arts, and technical curricula. A bachelor of science or a bachelor of arts degree in Chemistry may be earned. In addition, a bachelor of science degree in Chemistry Education is available.

Completion of the B.S. degree in chemistry prepares a student for employment as a practicing laboratory chemist in a wide variety of industrial, educational, and governmental enterprises. It provides excellent preparation for admission into graduate programs in chemistry, biochemistry, pharmacology, toxicology, food science, environmental science, and other related areas and for admission into the professional schools of medicine, dentistry, and veterinary medicine.

Completion of the B.A. degree in chemistry prepares a student to seek a career in areas in which a knowledge of matter, energy, and their transformation is important including the chemical, food, health, environmental, and energy industries. Students frequently combine the B.A. degree with a second major such as biology, mathematics, and management.

A grade point average of 2.00 in all major course work taken at SMSU including courses transferred from other institutions.

Note: Students must complete a minimum of 120 credits in order to graduate with a Bachelor's degree.

Programs Bachelors

- Chemistry Education, BS (<http://catalog.smsu.edu/academic-programs-degrees/chemistry/chemistry-education-bs/>)
- Chemistry, BA (<http://catalog.smsu.edu/academic-programs-degrees/chemistry/chemistry-ba/>)
- Chemistry, BS (<http://catalog.smsu.edu/academic-programs-degrees/chemistry/chemistry-bs/>)

Minor

- Chemistry, Minor (<http://catalog.smsu.edu/academic-programs-degrees/chemistry/chemistry-minor/>)

Faculty

Noelle Beyer (<https://www.smsu.edu/directory/?d=employee&name=00002276#individualTables>)

Jay Brown (<https://www.smsu.edu/directory/?d=employee&name=00002790#individualTables>)

John Hansen (<https://www.smsu.edu/directory/?d=employee&name=00000381#individualTables>)

Frank Schindler (<https://www.smsu.edu/directory/?d=employee&name=00188148#individualTables>)

Undergraduate Courses

CHEM 100 Nursing Chemistry Credits: 3

Introduces concepts and principles of chemistry and scientific measurements with an emphasis on applications to the health sciences. Topics include atomic and molecular structure, bonding, chemical notation, nomenclature, stoichiometry, common organic functional groups, and the most important classes of biological molecules.

Spring: Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001804/>)

CHEM 100L Nursing Chemistry Lab Credits: 1

Introduces concepts and principles of chemistry and scientific measurements with an emphasis on applications to the health sciences. Topics include atomic and molecular structure, bonding, chemical notation, nomenclature, stoichiometry, common organic functional groups, and the most important classes of biological molecules.

Spring: Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001805/>)

CHEM 110 Our Chemical World Credits: 3

An introductory course for non-science majors emphasizing elementary concepts of chemistry as they relate to society and the environment. May not be used as a prerequisite for any other chemistry course.

Goal: Goal: 03- Natural Science 10- People/Environment

Fall: All Years **Summer** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001826/>)

CHEM 110L Our Chemical World Lab Credits: 1

An introductory course for non-science majors emphasizing elementary concepts of chemistry as they relate to society and the environment. May not be used as a prerequisite for any other chemistry course.

Goal: Goal: 03- Natural Science

Fall: All Years **Summer** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001828/>)

CHEM 111 Chemistry in Our Daily Lives Credits: 3

Lecture focuses on the specific chemicals and chemical systems that are encountered in homes and on farms, and includes the effect they have on a persons immediate environment and health. Laboratory work uses mainly chemicals obtained from stores to reinforce the connection between chemical theory and practice. May not be used as a prerequisite for any other chemistry course.

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001827/>)

CHEM 111L Chemistry in Our Daily Lives Lab Credits: 1

Lecture focuses on the specific chemicals and chemical systems that are encountered in homes and on farms, and includes the effect they have on a persons immediate environment and health. Laboratory work uses mainly chemicals obtained from stores to reinforce the connection between chemical theory and practice. May not be used as a prerequisite for any other chemistry course.

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001829/>)

CHEM 121 Basic Chemistry Credits: 3

For students interested in agriculture, foods, health, or technology. Introduces basic concepts and fundamental principles of chemistry with an emphasis on applications to the above areas. The required preparation for this course is three years of high school mathematics or MATH 060.

Goal: Goal: 03- Natural Science

Fall: All Years **Summer** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00000228/>)

CHEM 121L Basic Chemistry Lab Credits: 1

For students interested in agriculture, foods, health, or technology. Introduces basic concepts and fundamental principles of chemistry with an emphasis on applications to the above areas.

Goal: Goal: 03- Natural Science

Fall: All Years **Summer** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001420/>)

CHEM 122 Introductory Organic/Biochemistry Credits: 3

For students interested in agriculture, foods, health, or technology. Brief study of organic and biochemistry with an emphasis on applications to the above areas.

Pre-Requisite : CHEM 121 OR CHEM 231

Spring: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00000229/>)

CHEM 122L Introduction to Organic/Biochemistry Lab Credits: 1

For students interested in agriculture, foods, health, or technology. Brief study of organic and biochemistry with an emphasis on applications to the above areas.

Pre-Requisite : CHEM 121L OR CHEM 231L

Spring: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001421/>)

CHEM 186 Special Topics in Chemistry Credits: 1-4

Fall: Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00002072/>)

CHEM 231 General Chemistry I Credits: 3

First course in chemistry for students majoring in a science. Topics include chemical and physical properties of matter, atomic and molecular structure, bonding, chemical notation, inorganic nomenclature, stoichiometry, and periodic laws. The required preparation for this course is three years of high school mathematics or MATH 110.

Goal: Goal: 03- Natural Science

Fall: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001657/>)

CHEM 231L General Chemistry I Lab Credits: 1

First course in chemistry for students majoring in a science. Topics include chemical and physical properties of matter, atomic and molecular structure, bonding, chemical notation, inorganic nomenclature, stoichiometry, and periodic laws.

Goal: Goal: 03- Natural Science

Fall: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001658/>)

CHEM 232 General Chemistry II Credits: 3

Continuation of CHEM 231. Topics include molecular bonding and shapes, equilibrium, kinetics, and acid/base chemistry. Descriptive inorganic chemistry is emphasized. Laboratory work includes experiments related to the lecture material including qualitative inorganic analysis.

Pre-Requisite : CHEM 231

Spring: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001654/>)

CHEM 232L General Chemistry II Lab Credits: 2

Continuation of CHEM 231. Topics include thermodynamics, equilibrium, kinetics, acid/base chemistry, oxidation and reduction, descriptive inorganic chemistry, and nuclear chemistry. Laboratory work includes experiments related to the lecture material including quantitative analysis and qualitative inorganic analysis.

Pre-Requisite : CHEM 231

Spring: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001655/>)

CHEM 243 Analytical Chemistry I Credits: 5

Introduction, theory, and hands-on application of instrumentation used in Chemical, Medical, Pharmaceutical, Environmental, Agrochemical, and Food industries. Topics may include titrimetric and gravimetric analyses, spectroscopy, chromatography, and electrochemistry.

Pre-Requisite : CHEM 232

Spring: Even Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00168071/>)

CHEM 286 Special Topics Credits: 1-4

A study of more advanced topics in chemistry not normally provided as part of the curriculum.

Fall: Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00000234/>)

CHEM 292 Honors Credit in Chemistry Credits: 1

An independent study course designed primarily for Honors Program students. This course allows more in-depth or comprehensive study or research by certain students concurrently enrolled in at least one other chemistry course.

Fall: Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00000235/>)

CHEM 320 Soil Chemistry Credits: 3

Fundamentals of soil chemical properties and processes at the mineral/water interface important for the sound management of soil resources. Topics include sorption/desorption of inorganic and organic compounds, distributive reactivity models, mobile/immobile sorption domains, bioavailability of nutrients and contaminants, oxidation/reduction, solid-phase equilibria, soil organic matter, soil mineralogy, ion exchange complexation, soil acidity, and saline/sodic soils.

Pre-Requisite : CHEM 122

Fall: Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00198239/>)

CHEM 333 Intermediate Inorganic Chemistry Credits: 4

A study of bonding theories, structure, stereochemistry, and acid base reactivity of inorganic compounds with an emphasis on main group elements. Symmetry and group theory, topics related to transition metal complexes, coordination chemistry, and instrumentation in inorganic chemistry are discussed.

Pre-Requisite : CHEM 232

Fall: Even Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001635/>)

CHEM 344 Instrumental Analysis Credits: 4

Theory and techniques of modern instrumental methods of qualitative and quantitative analysis. Techniques covered include spectroscopic methods, chromatography, mass spectrometry, and electroanalytical methods.

Pre-Requisite : CHEM 231 AND CHEM 231L

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00002722/>)

CHEM 351 Organic Chemistry I Credits: 3

An examination of the principle functional groups of carbon compounds and the relationship of their structure to physical and chemical properties. Laboratory work includes chemical and instrumental methods of structure elucidation.

Pre-Requisite : CHEM 232

Fall: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001650/>)

CHEM 351L Organic Chemistry I Lab Credits: 2

An examination of the principle functional groups of carbon compounds and the relationship of their structure to physical and chemical properties. Laboratory work includes chemical and instrumental methods of structure elucidation.

Pre-Requisite : CHEM 232

Fall: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001651/>)

CHEM 352 Organic Chemistry II Credits: 3

Continuation of CHEM 351.

Pre-Requisite : CHEM 351

Spring: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001648/>)

CHEM 352L Organic Chemistry II Lab Credits: 2

Continuation of CHEM 351.

Pre-Requisite : CHEM 351

Spring: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001649/>)

CHEM 353L Organic Spectroscopic Analysis Credits: 2

Students in this laboratory course receive training on the acquisition and analysis of spectroscopic data from organic compounds. The focus of the course is Nuclear Magnetic Resonance (NMR) Spectroscopy but additional techniques may include Infrared (IR) Spectroscopy, Mass Spectroscopy (MS), and Ultraviolet/Visible (UV/Vis) Spectroscopy.

Pre-Requisite : CHEM 351L

Fall: Even Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00162524/>)

CHEM 363 Basic Physical Chemistry Credits: 4

An introduction to chemical thermodynamics and its applications; chemical kinetics; and the kinetic theory of gases (lecture and laboratory).

Pre-Requisite : CHEM 232

Spring: Odd Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00225743/>)

CHEM 364 Chemical Thermodynamics and Kinetics Credits: 3

An introduction to chemical thermodynamics and its applications; chemical kinetics; and the kinetic theory of gases.

Spring: Even Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001639/>)

CHEM 364L Chemical Thermodynamics and Kinetics Laboratory Credits: 1

Laboratory to accompany CHEM 364

Spring: Even Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00162555/>)

CHEM 365 Quantum Chemistry and Spectroscopy Credits: 3

Quantum mechanics and its applications to molecular structure and spectroscopy; statistical mechanics of molecules; and chemical reaction dynamics.

Pre-Requisite : MATH 151 AND PHYS 141 AND PHYS 142 AND CHEM 232 OR MATH 151 AND PHYS 181 AND PHYS 182 AND CHEM 232

Fall: Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001638/>)

CHEM 365L Quantum Chemistry and Spectroscopy Laboratory Credits: 1

Laboratory to accompany CHEM 365

Fall: Department Discretion **Spring:** Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00162557/>)

CHEM 373 Biochemistry Credits: 3

This course examines the fundamental structures, reactions, and metabolism of biologically important compounds, including amino acids, proteins, carbohydrates, lipids, and nucleic acids.

Pre-Requisite : CHEM 352

Spring: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00162551/>)

CHEM 373L Biochemistry Lab Credits: 1

Structure, reactions and metabolism of biologically important compounds.

Spring: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00162552/>)

CHEM 420 Chemistry Seminar Credits: 1-2

Use of the chemical literature, current developments in research, technical speaking and writing.

Pre-Requisite : CHEM 363 OR CHEM 364 OR CHEM 365

Spring: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00001641/>)

CHEM 437 Adv Inorganic Chemistry Credits: 3

A study of advanced topics in inorganic chemistry, focusing on the development of and current trends in main group and transition-metal coordination, organometallic, and inorganic soil chemistry.

Pre-Requisite : CHEM 232 OR CHEM 333

Fall: Department Discretion **Spring**: Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00153310/>)

CHEM 447 Advanced Analytical Chemistry Credits: 3

Advanced theory and application of topics introduced in Analytical Chemistry I (CHEM 243). Subjects may include electrochemistry, chromatography, and Nuclear Magnetic Resonance (NMR) spectroscopy.

Pre-Requisite : CHEM 232 OR CHEM 243

Fall: Department Discretion **Spring**: Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00002140/>)

CHEM 457 Advanced Organic Chemistry Credits: 3

Transition states, reactive intermediates, free energy relationships, and kinetic isotope effects in the elucidation of reaction mechanisms.

Pre-Requisite : CHEM 352 AND CHEM 364 OR CHEM 352 AND CHEM 365

Fall: Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00002139/>)

CHEM 467 Computational Chemistry Credits: 3

An introduction to current quantum mechanical methods of computing molecular structure and spectra as well as chemical reaction dynamics. Common semi-empirical methods are discussed as are Hartree-Fock and density functional methods. Both theory and practical experience with computer calculations are included.

Pre-Requisite : CHEM 364

Fall: Department Discretion **Spring**: Department Discretion **Summer**: Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00002222/>)

CHEM 470 Advanced Laboratory Credits: 1-4

An introduction to the integrated practice of chemical science, including the use of primary chemical literature, laboratory research, and reporting research results in papers and seminars. May be repeated for additional credit. Students completing 3 credits or more of Advanced Laboratory must complete an independent laboratory research project and report its results in a major paper as well as in a public seminar.

Pre-Requisite : CHEM 363 AND CHEM 352 OR CHEM 364 AND CHEM 352 OR CHEM 365 AND CHEM 352

Spring: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00000247/>)

CHEM 486 Advanced Topics Credits: 1-4

Organometallics, nonaqueous solution reactions, solid-state chemistry, polymers, computers in chemistry, environmental chemistry, or similar topics.

Spring: Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00000248/>)

CHEM 494 Independent Study Credits: 1-4

Arranged Independent Study in Chemistry

Fall: All Years **Spring**: All Years

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00002616/>)

CHEM 499 Internship in Chemistry Credits: 1-16

Supervised work in chemistry that takes place off campus. Prior approval of the project and credits to be taken, and final report are required by the Chemistry Program.

Fall: Department Discretion **Spring**: Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00000249/>)

Graduate Courses

CHEM 543 Quantitative Chemical Analysis Credits: 4

Advanced theory and application of classic wet-bench analytical chemistry techniques. Topics may include: chemical measurements, experimental error, statistics, activity coefficients, coupled chemical equilibria, polyprotic acid/base chemistry, gravimetric and volumetric analyses, and electrochemistry. A completed undergraduate degree in either Chemistry or Chemical Education is required to register for this course.

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00181920/>)

CHEM 564 Thermodynamics, Equilibrium, and Kinetics for Teachers Credits: 2

Chemical thermodynamics and its applications to chemical equilibrium. Equilibrium calculations including applications to chemical analysis. Elementary theories of chemical reaction rates. Related laboratory exercises with emphasis on applications to teaching of high school chemistry.

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00002211/>)

CHEM 567 Educational Applications of Computational Chemistry Credits: 3

An introduction to current quantum mechanical methods of computing molecular structure and spectra. Common semi-empirical methods are discussed as are Hartree-Fock and density functional methods. Both theory and practical experience with computer calculations are included. Applications of these methods to instruction in introductory chemistry courses are emphasized, including visualization of molecular orbitals, understanding molecular shapes, and predicting chemical properties and spectra.

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00182524/>)

CHEM 589 Special Topics in Chemistry Credits: 1-4

Advanced interdisciplinary study of the chemical sciences. Intensive lectures, literature reviews, and discussions on fundamental and contemporary topics that have shaped and continue to shape our understanding of chemical systems. Topics vary based on the interests of the students and the instructor.

Fall: Department Discretion **Spring**: Department Discretion **Summer**: Department Discretion

Course Outline (<https://eservices.minnstate.edu/registration/rest/rcld/0075/curricld/00194820/>)