# Program Overview

Students will gain a specialized body of knowledge that furthers their academic development, proficiency in laboratory techniques, and professional growth.

# Application Requirements

The items listed below are required for admission consideration for applicable semesters of entry during the current academic year. Submission instructions, additional details, and changes to admission requirements for semesters other than the current academic year can be found on The Graduate College's website (http://www.gradcollege.txstate.edu). International students should review the International Admission Documents page (http://mycatalog.txstate.edu/graduate/admission-documents/international/) for additional requirements.

- completed online application
- $55 nonrefundable application fee

  or

- $90 nonrefundable application fee for applications with international credentials
- baccalaureate degree in chemistry from a regionally accredited university (Non-U.S. degrees must be equivalent to a four-year U.S. Bachelor's degree. In most cases, three-year degrees are not considered. Visit our International FAQs (https://www.gradcollege.txst.edu/international/faqs.html) for more information.)
- official transcripts from **each institution** where course credit was granted
- a 3.0 overall GPA or 3.0 GPA in the last 60 hours of undergraduate course work (plus any completed graduate courses)
- GRE not required
- statement of purpose discussing career goals and undergraduate experiences
- two letters of recommendation regarding the student's academic potential and undergraduate research experience

**Approved English Proficiency Exam Scores**

Applicants are required to submit an approved English proficiency exam score that meets the minimum program requirements below unless they have earned a bachelor's degree or higher from a regionally accredited U.S. institution or the equivalent from a country on our exempt countries list (http://www.gradcollege.txstate.edu/international/language.html#waiver).

- official TOEFL iBT scores required with a 78 overall
- official PTE scores required with a 52 overall
- official IELTS (academic) scores required with a 6.5 overall and minimum individual module scores of 6.0
- official Duolingo scores required with a 110 overall
- official TOEFL Essentials scores required with an 8.5 overall

This program does **not** offer admission if the scores above are not met.

# Degree Requirements

The Master of Arts (M.A.) degree with a major in Chemistry requires 30 semester credit hours.

# Course Requirements

| Code | Title | Hours |
|---|---|---|
| **Required Courses** | | |
| CHEM 5321 | Advanced Organic Chemistry | 3 |
| or CHEM 5330 | Physical Chemistry | |
| CHEM 5365 | Separation Methods in Chemical Analysis | 3 |
| CHEM 5370 | Problems in Chemistry | 3 |
| CHEM 5395 | Fundamentals of Research | 3 |
| **Electives** | | |
| Choose 18 hours of advisor-approved electives | | 18 |
| **Total Hours** | | **30** |

# Comprehensive Examination Requirement

A written comprehensive examination given by three graduate faculty members is required. A second attempt is allowed if the student fails to pass.

Students who do not successfully complete the requirements for the degree within the timelines specified will be dismissed from the program.

Master's level courses in Chemistry and Biochemistry: CHEM

# Courses Offered

## Chemistry (CHEM)

**CHEM 5110. Seminar in Chemistry.**
A course designed to acquaint the graduate student with current research areas in chemistry. May be repeated twice for total of 3 semester hour credit.
**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5195. Professional Development of Graduate Assistants.**
This course is designed to develop and enhance graduate assistants' laboratory instruction abilities. Topics covered in the course include effective lecture techniques, laboratory safety, theory and practical knowledge on laboratory experiments and laboratory section management. This course does not earn graduate credit.
**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**
**Course Attribute(s):** Graduate Assistantship|Exclude from Graduate GPA
**Grade Mode:** Leveling/Assistantships

**CHEM 5199B. Thesis.**
This course represents a student's continuing thesis enrollment. The student continues to enroll in this course until the thesis is submitted for binding.
**1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.**
**Grade Mode:** Credit/No Credit

**CHEM 5285. Laboratory Development Practice.**
This course develops the laboratory instructional abilities of post-baccalaureate students seeking either 8-12 Chemistry or 8-12 Physical Science Teaching Certification. Topics include both traditional laboratory techniques and guided inquiry techniques, safety, laboratory management, pedagogical theory and practical knowledge of laboratory experiments.
**2 Credit Hours. 1 Lecture Contact Hour. 2 Lab Contact Hours.**
**Course Attribute(s):** Lab Required
**Grade Mode:** Standard Letter

**CHEM 5295. Professional Development of Graduate Assistants.**
This course is designed to develop and enhance graduate assistants' laboratory instruction abilities. Topics covered in the course include effective lecture techniques, laboratory safety, theory and practical knowledge on laboratory experiments and laboratory section management. This course does not earn graduate credit.
**2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.**
**Course Attribute(s):** Graduate Assistantship|Exclude from Graduate GPA
**Grade Mode:** Leveling/Assistantships

**CHEM 5299B. Thesis.**
This course represents a student's continuing thesis enrollment. The student continues to enroll in this course until the thesis is submitted for binding.
**2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Credit/No Credit

**CHEM 5310. Medicinal Chemistry.**
This course surveys modern approaches to drug discovery and mechanisms of drug action with the focus on molecular structures of drugs. Examples of drug discovery for the chemotherapy of cancer, microbial and cardiovascular diseases will be examined.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5311. Natural Products, Anti-Infective, and Anti-Cancer Agents.**
This course is designed to introduce natural products by discussing their important classes (secondary metabolites), classification, nomenclature, structure, biosynthesis, occurrence and structure elucidation. The study of their utilization in medicine as leads for the development of new antimicrobial and anticancer agents will constitute the main focus of the course. The students will learn how to utilize their knowledge of organic chemistry and biochemistry gained in undergraduate courses toward the application of advanced research active areas at the chemistry-biology interface.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5312. Organometallic Chemistry.**
This course will survey the structure, bonding, and reactivity of organometallic complexes. Homogeneous catalysis of the transition metals as well as the main group elements along with specialized "seminal research papers" in the field of organometallic chemistry will also be presented.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5313. Principles and Applications of Mass Spectrometry.**
This course is designed for graduate chemistry and biochemistry majors. Sections of the course are devoted to the theory and practice of mass spectrometry. Application to chemistry, biochemistry, biology and materials science will be explored.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5320. Modern Molecular Modeling.**
The application of computational techniques to molecular modeling. Topics covered include quantum mechanical modeling, force field based molecular modeling, energy minimization, molecular dynamics, vibrational spectra, solution of crystalline structures, diffraction patterns, molecular blends, phase equilibria, crystal morphology, physical property prediction, and mesoscale modeling. Prerequisites: CHEM 3340 with a grade of "D" or better or instructor approval.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5321. Advanced Organic Chemistry.**
Study of the relation of the following topics to structure and reactions of organic compounds: bonding, stereochemistry, acid-base concepts, physical organic chemistry, reactive species, and mechanisms.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5330. Physical Chemistry.**
Fundamentals of physical chemistry are surveyed, emphasizing application in the other chemical sub-disciplines. Topics include classical thermodynamics, kinetics, atomic structure, and molecular spectroscopy.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5333. Spectroscopy.**
Study of various spectrometric techniques in qualitative and structural analysis of chemical substances. Students who have completed CHEM 4333 or its equivalent may not take this course for master's credit.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5341. Inorganic Chemistry.**
This course will review essential concepts in inorganic chemistry including atomic structure, bonding theory, acid-base chemistry, solid state structures, and coordination chemistry. Analytical techniques for characterizing inorganic structures will be discussed along with current topics in the field.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5342. Bioinorganic Chemistry.**
This course is designed to provide a broad overview of metalloprotein active site design and reaction mechanisms catalyzed by metalloenzymes. Training sessions on the use of contemporary protein visualization tools will be provided and used throughout the course. Topics covered in the course include dioxygen transport and activating proteins, electron transfer proteins, dinitrogen (N2), and hydrogen (H2) activation, photosystem and oxygen evolution, zinc containing proteins, CO2 reduction, and modern advancements in the field of bioinorganic chemistry. Students can expect to develop strong foundational knowledge in metalloenzyme structure, function, and reaction mechanisms.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5351. Introduction to Polymers and Polymer Synthesis.**
This course is designed to develop the student's general understanding of polymer history and importance as well as terminology, structure, and synthesis. The overall scope of the course will be to develop the student's general knowledge of polymer synthesis and structure. Students who have completed CHEM 4351 or its equivalent may not take this course for master's credit.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5353. Polymer Processing and Characterization.**
This course is designed to explore the areas of polymer processing and characterization. Students will be introduced to extrusion, injection molding, film formation, thermoforming, thermal-mechanical measurements, classical mechanical testing, thermal-optical measurements, and methods for determination of polymer molecular weight. Prerequisites: CHEM 5351 with a grade of "C" or better.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5355. Physical Chemistry of Polymers.**
A study of the physical chemistry of polymers. Subjects covered include thermodynamics, kinetic polymerization, phase relationships, molecular geometry, spectroscopy of polymers, polymer physics and mechanical behavior, polymer blends, rheology, and polymer composites.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5365. Separation Methods in Chemical Analysis.**
The principles of gas chromatography, capillary electrophoresis, and mass spectrometry are discussed with a balance among theory, practice, and application.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5366. Quantitative Methods in Biophysical Chemistry.**
This course will integrate the physical, chemical, and biological aspects of fundamental biophysical methods, including spectroscopy, calorimetry, and hydrodynamics. Students will develop a quantitative skillset in multiple analytical methods that are used to characterize a variety of biological systems. This course will provide students with the physical and chemical foundation to quantitatively study biological macromolecules at multiple levels of complexity.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5370. Problems in Chemistry.**
Open to graduate students on an individual basis by arrangement with the faculty member concerned. May be repeated once with different emphasis for additional credit.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5375. Biochemistry.**
A course devoted to a study of the chemistry of carbohydrates, lipids, proteins, enzymes, and nucleic acids. A study of enzyme kinetics and thermodynamics of coupled reactions is included.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5381. Physical Biochemistry.**
An introduction to the physical techniques of biochemistry with emphasis on the interpretation of experimental data obtained from electrophoresis, chromatography, immunological methods, ultracentrifugation, spectroscopy and emerging techniques.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5382. Enzymology.**
A study of the chemical and physical properties of enzymes. Topics will include structure-function relationships, elucidation of chemical and kinetic mechanisms, and the role of enzymes in metabolism.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5383. Molecular Biology & Molecular Genetics.**
This course addresses the basic genetic mechanisms of bacteria and eukaryotes and introduces some examples of the biochemical and genetic techniques employed to study cells, tissues, and organisms.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5384. Current Topics in Biochemistry and Molecular Biology.**
Course provides students with advanced knowledge in the areas of biochemistry and molecular biology. Topics include signal transduction and the molecular biology of cancer, as well as emerging topics in Genomics, Proteomics, and other new developments in biochemistry. May be repeated once for credit. Prerequisites: CHEM 5381 with a grade of "C" or better.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Course Attribute(s):** Exclude from 3-peat Processing
**Grade Mode:** Standard Letter

**CHEM 5385. Metabolism.**
A study of biodegradation and biosynthesis of carbohydrates, lipids, amino acids, proteins, and nucleic acids. Students who have completed CHEM 4385 or its equivalent may not take this course for master's credit.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5386. Proteins.**
This course will cover advanced biochemistry topics related to proteins. Topics will include protein structure, structure-function relationships, and current methodologies for examining proteins in addition to current findings in primary literature.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5387. Nucleic Acids Chemistry.**
This course will cover advanced biochemistry topics related to nucleic acids. Topics will include nucleic acid structures and properties, catalytic nucleic acids, protein-nucleic acid interactions, higher order complexes of protein-nucleic acids, and current methodologies for examining nucleic acids in addition to current findings in primary literature. Prerequisite: CHEM 5383 with a grade of "C" or better.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5390. Supramolecular Chemistry.**
This course is designed to be a survey of the nature of non-covalent interactions between host and gust species. Emphasis will be focused on the rational design of hosts, thermodynamic and kinetic parameters involved in binding and the applications of various binding/recognition phenomena.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5391. Chemical Biology.**
This course will introduce the emerging field of chemical biology and common tools that are used to analyze and manipulate biological processes with small molecules. Students will develop a strong foundation in the design and synthesis of chemical tools to interrogate biological systems and focus on implementing and interpreting assays with these tools, using examples from the current literature.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Standard Letter

**CHEM 5395. Fundamentals of Research.**
Course is designed to acquaint the beginning graduate student with materials and methods of chemical research. (MULT & MULP).
**3 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.**
**Course Attribute(s):** Multicultural Perspective|Multicultural Content
**Grade Mode:** Standard Letter

**CHEM 5396A. Materials Chemistry.**
This course covers chemistry of the synthesis, structure, and properties of materials, including nanomaterials, and inorganic, organic and hybrid materials. An overview of solid-state chemistry and the principles and theory of sol-gel chemistry and materials characterization methods will be provided. Current topics and trends in materials chemistry and applications of materials in energy, electronics, and healthcare will be covered. Students will complete an independent report on synthesis, structure and properties of a material.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Course Attribute(s):** Exclude from 3-peat Processing|Topics
**Grade Mode:** Standard Letter

**CHEM 5399A. Thesis.**
This course represents a student's initial thesis enrollment. No thesis credit is awarded until student has completed the thesis in CHEM 5399B.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Credit/No Credit

**CHEM 5399B. Thesis.**
This course represents a student's continuing thesis enrollment. The student continues to enroll in this course until the thesis is submitted for binding.
**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Credit/No Credit

**CHEM 5599B. Thesis.**
This course represents a student's continuing thesis enrollment. The student continues to enroll in this course until the thesis is submitted for binding.
**5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Credit/No Credit

**CHEM 5999B. Thesis.**
This course represents a student's continuing thesis enrollment. The student continues to enroll in this course until the thesis is submitted for binding. Graded on a credit (CR), progress (PR), no-credit (F) basis.
**9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.**
**Grade Mode:** Credit/No Credit