The Chemistry department offers the following graduate degree program:

Master of Science - Chemistry (http://catalog.uah.edu/grad/colleges-departments/science/chemistry/chemistry-ms/)
Doctor of Philosophy - Chemistry (http://catalog.uah.edu/grad/colleges-departments/science/chemistry/chemistry-phd/)

### Master of Science - Chemistry

**Admission Requirements**

General requirements of the Graduate School must be satisfied. In addition, students admitted to the graduate chemistry program are assumed to have training equivalent to the chemistry B.S. degree recommended by the American Chemical Society (ACS). The degree includes lecture and laboratory work in organic chemistry, physical chemistry, inorganic chemistry, analytical chemistry, biochemistry, polymer chemistry, and materials chemistry. Graduation from an undergraduate program not adhering to ACS standards does not preclude entrance into the UAH program. Students should realize, however, that if deficiencies exist, some additional undergraduate courses might be required. The time required to complete the M.S. degree may then be proportionately increased.

**Program Objective**

The Department of Chemistry is to provide high-quality education in all aspects of chemistry. Graduates of the Master of Science program will present their work in well-respected journals with significant impact. Our second objective is to educate our students in chemistry to obtain either satisfactory employment or enrollment in a graduate or professional degree program.

**Learning Outcomes**

Students will demonstrate:

- Ability to effectively present chemical knowledge in writing
- Ability to deliver an effective oral presentation of their research
- An excellent understanding of the basic concepts, methods, terminology, and theories of modern chemistry related to their research interests

### Chemistry PhD Program

**Admission Requirements**

In addition to fulfilling admission requirements (https://www.uah.edu/admissions/graduate/) set by the Graduate School, applicants must also have:

- A bachelor’s degree in chemistry, chemical engineering or materials science or in a closely related field from an accredited college or university;
- Candidates who apply for the Executive path must have a Master’s of Science degree in Chemistry or in a related field and/or three years of experience in the chemical industries;
- A minimum grade point average (GPA) of 3.000 overall;
- Three letters of reference;
- A personal statement;
- For international students, language proficiency as outlined on the Graduate Admissions for International Students (http://catalog.uah.edu/webpagehttps://www.uah.edu/admissions/graduate/apply-for-admission/international-students/#:~:text=English%20Language%20Proficiency%2C%20A%20scores) webpage must be shown;
- An entrance interview conducted in person or via Zoom, or a comparable platform.

Applicants may be admitted conditionally if they do not meet admission requirements but indicate the potential for success in the Chemistry PhD program. Applicants should have knowledge from coursework in the areas of organic, inorganic, physical, analytical chemistry and biochemistry, with the
respective hands-on (not virtual) laboratory experience in the above-indicated subsections of chemistry. Students with deficiencies in any of these areas may be admitted conditionally.

Application Process

- **Applicants must apply by January 31** to be admitted for the Fall semester in the same year and by **August 31** to be admitted for the Spring semester of the following year.
- **An interview** in person or via Zoom, or a comparable platform, will be arranged for the applicant throughout the month of February (September for Spring admission), where the applicant is expected to describe their chemistry education and potential research experience.
- Applicants should obtain a response to their application by **April 1** (**October 15** for Spring admission).
- The applicant’s decision on acceptance is **due no later than April 30** (**October 31** for Spring admission).

Available Assistantships

The UAH Graduate School (https://www.uah.edu/graduate/) has information about:

- Teaching Assistantships
- Research Assistantships
- Fellowships

Graduate Teaching Assistants are expected to teach Chemistry undergraduate laboratory courses.

Applicants interested in applying for an assistantship may upload their assistantship application (https://www.uah.edu/admissions/graduate/financial-aid/assistantships/) under the “Documents” section of the application. Providing GRE scores with an application package is optional but can be advantageous to securing an assistantship.

Master’s Program in Chemistry

- Chemistry, MS (http://catalog.uah.edu/grad/colleges-departments/science/chemistry/chemistry-ms/)

Chemistry PhD Program

- Chemistry, PhD (http://catalog.uah.edu/grad/colleges-departments/science/chemistry/chemistry-phd/)

CH 500 - TOPICS IN CHEMISTRY
Semester Hours: 1-3

Advanced laboratory research in one of the departmental research groups. The student works on an independent or group research project. Completion of the course requires an appropriate written and oral report. Prerequisites: Approval of instructor.

CH 521 - CHEMICAL INSTRUMENTATION
Semester Hours: 3

Use of basic instrumentation in NMR, mass spectrometric, chromatographic, and spectrophotometric analysis.

CH 522 - CHEMICAL INSTRUMENTATION LABORATORY
Semester Hour: 1

Complements the lecture material for CH 521. Introduction to modern analytical instrumentation including IR, UV and atomic absorption spectrophotometers, nuclear magnetic resonance, electroanalytical equipment, and gas and liquid chromatographs. Prerequisite with concurrency: CH 521.

CH 549 - SPECTROSCOPY & MOLECULAR STRUCTURE
Semester Hours: 3

Intermediate level treatment of principles of spectroscopy and their application to determination of molecular structure.

CH 553 - INTRO QUANTUM MECHANICS I
Semester Hours: 3

Waves and particles; Bohr's model; de Broglie waves, wave-packets, uncertainty principle; quantum mechanics postulates; Schroedinger equation; systems in 1, 2 & 3 dimensions; hydrogen atom. Same as PH 551, OSE 555, and MTS 651.

CH 554 - INTRO QUANTUM MECHANICS II
Semester Hours: 3

Angular momentum and spin; atomic structure and spectrum; time-independent perturbation theory, variational methods; time-dependent perturbation theory and interactions of light with matter; scattering theory; electronic structure of solids; relativistic quantum mechanics. Same as: PH 552, MTS 652. Prerequisite: PH 551 or CH 553.
CH 561 - BIOCHEMISTRY I
Semester Hours: 3

Structural chemistry and function of biomolecules, mechanisms of biochemical reactions, enzyme kinetics, and energy transfer. Same as: BYS 547.

CH 562 - BIOCHEMISTRY II
Semester Hours: 3

Metabolism, biosynthesis of macromolecular precursors, storage, transmission, and expression of genetic information, and molecular physiology. Same as BYS 548. Prerequisites: CH 561 or BYS 547.

CH 600 - ADVANCED INORGANIC CHEMISTRY
Semester Hours: 3

Survey with emphasis on structure and reactivity of inorganic compounds.

CH 602 - CHEMISTRY OF COORDINATION COMPOUNDS
Semester Hours: 3

Modern bonding theory and stereochemistry of coordination compounds.

CH 621 - METHODS OF CHEMICAL ANALYSIS
Semester Hours: 3

Literature, seminar course. Theory and methodology of various techniques of chemical analysis.

CH 631 - SYNTHETIC ORGANIC CHEMISTRY
Semester Hours: 3

Survey of certain reactions that enjoy widespread application to the synthesis of organic compounds.

CH 632 - PHYSICAL ORGANIC CHEMISTRY
Semester Hours: 3

Reactive intermediates, structure-activity relationships, reaction mechanisms and techniques used to determine them.

CH 633 - ORGANIC STRUCTURE DETERMINATION
Semester Hours: 3

Structure determination of organic molecules using spectroscopic methods, especially NMR, IR, and MS. Emphasis on the theory and interpretation of many NMR methods useful in chemistry research.

CH 634 - MOLECULAR MODELING
Semester Hours: 4

Molecular modeling methods, such as molecular mechanics, molecular docking, molecular orbital theory, and density functional theory, will be used to investigate conformational properties of organic compounds, molecular interactions between biological macromolecules and organic ligands, electronic structure of organic and inorganic compounds, frontier molecular orbitals, pericyclic reactions, and reactive intermediates. Extensive computational laboratory work included.

CH 635 - CHEMICAL TOXICOLOGY
Semester Hours: 3

An introduction to the principles of chemical toxicology, including the effects of drugs, environmental pollutants, natural toxins and venoms, and other potentially hazardous chemicals at the physiological, cellular, and molecular level.

CH 640 - ADVANCED CHEMICAL THERMODYNAMICS
Semester Hours: 3


CH 641 - STATISTICAL THERMODYNAMICS
Semester Hours: 3

Principles leading to the development of Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics. Thermodynamic properties calculated from partition functions.

CH 642 - ADVANCED CHEMICAL DYNAMICS
Semester Hours: 3

Non-equilibrium thermodynamics, macroscopic and microscopic theories of diffusion, chemical reaction rate laws and mechanisms, transition state theory, gas phase molecular dynamics, electrical conduction in electrolyte solutions, electrode kinetics. Prerequisite: CH 640.
CH 643 - QUANTUM CHEMISTRY
Semester Hours: 3
Application of quantum theory to the chemical bond.

CH 644 - CHEMICAL ELECTRODYNAMICS
Semester Hours: 3
Maxwell's equations applied to electrodynamic problems in chemistry. Theory of dielectrics, dipole moments, Beer's law, Landolt's rule, light scattering, magnetic properties, quantum theory of radiation.

CH 645 - POLYMER PHYSICAL CHEMISTRY
Semester Hours: 3
Introduction to structure, properties and processing of polymers. Physical behavior of polymers, structure-property relationships, polymer characterization, thermodynamics of polymer solutions and melts, mechanical evaluation of polymers. Same as MTS 747.

CH 646 - THERMODYNAMICS OF MATERIALS
Semester Hours: 3
Fundamental thermodynamic review, phase equilibrium, chemical reaction equilibrium, free energy, binary and ternary phase transformations, solution models and selected topics. Same as CHE 646 and MTS 646.

CH 647 - ADVANCED BIOPHYSICAL CHEMISTRY I
Semester Hours: 3
Topics include: computer data analysis and simulation, first and second laws of thermodynamics, free energy and equilibrium, calorimetry, protein stability, binding and interactions, solution thermodynamics, electrolytes.

CH 648 - ADVANCED BIOPHYSICAL CHEMISTRY II
Semester Hours: 3
Advanced biophysical chemistry, including biochemical reaction kinetics, enzyme catalysis, quantum mechanics, statistical thermodynamics, spectroscopy, including UV-VIS, fluorescence, circular dichroism, NMR, and Structure determinations. An emphasis is placed on the current research literature.

CH 649 - POLYMER SYNTHESIS & CHARACTERIZATION
Semester Hours: 3
Same as MTS 649.

CH 650 - PRINCIPLES OF THE LIQUID/SOLID INTERFACE
Semester Hours: 3
Applies principles in thermodynamics & kinetics to characterize surfaces & surface phenomena. Fundamental properties of gas-liquid, liquid-liquid, solid-liquid and solid-gas interfaces and phenomena at these interfaces. Same as MTS 650 and CHE 650.

CH 699 - MASTER'S THESIS
Semester Hours: 3-6
Required each semester a student is enrolled and receiving direction on a masters thesis. Minimum of two terms is required. (A maximum of six hours may be applied towards the degree).

CH 700 - CURRENT TOPICS IN CHEMISTRY
Semester Hours: 1-3
Advanced laboratory research in one of the departmental research groups. The student works on an independent or group research project. Completion of the course requires a written and an oral report. Prerequisite: approval of instructor.

CH 705 - SELECTED TOPICS IN INORGANIC CHEMISTRY
Semester Hours: 3
Prerequisites: CH 600 and approval of instructor.

CH 721 - SELECTED TOPICS IN ANALYTICAL CHEMISTRY
Semester Hours: 3
Prerequisites: CH 621 and approval of instructor.

CH 735 - SELECTED TOPICS IN ORGANIC CHEMISTRY
Semester Hours: 3
Prerequisites: CH 632 and approval of instructor.
CH 745 - SELECTED TOPICS IN PHYSICAL CHEMISTRY
Semester Hours: 3

CH 746 - SOLID STATE CHEMISTRY
Semester Hours: 3

Chemical properties of solids. Includes phase equilibria, chemical bonding in ionic and covalent crystals, thermodynamics of atomic defects, ionic conductivity in solids, corrosion, & introduction to surfaces and adsorption.

CH 765 - SELECTED TOPICS IN BIOCHEMISTRY
Semester Hours: 3

Prerequisites: approval of instructor.

CH 780 - CHEMISTRY SEMINAR
Semester Hour: 1

Required during each semester of residence.

CH 799 - DOCTORAL DISSERTATION
Semester Hours: 3-9