School of Natural Sciences and Mathematics

The School of Natural Sciences and Mathematics offers both graduate and undergraduate programs in Biology, Chemistry, Geosciences, Mathematical Sciences, and Physics, and a graduate program in Science Education. Undergraduate and post-baccalaureate programs in teacher certification are administratively housed in the School of Natural Sciences and Mathematics but serve other schools as well.

The undergraduate program in Biology provides a basic foundation in molecular and cell biology to prepare students for graduate studies in biology (B.S.), for professional studies in a wide variety of health-related areas, for secondary school teaching, and for employment as research assistants in pharmaceutical, biotechnology, government, and environmental science laboratories (B.S., B.A.).

The undergraduate program in Chemistry provides the fundamental knowledge required for professional participation in chemically oriented industries, for graduate study in chemistry, and for medical or dental studies (B.S.), or for secondary science teaching or ancillary positions (sales, legal, etc.) in the chemical industries (B.A.).

The undergraduate program in Geosciences provides a general scientific background suitable for some careers in business or law, for secondary school teaching (B.A.), or for employment as a professional geologist, or for graduate studies in Geosciences (B.S.).

The undergraduate programs in Mathematical Sciences (B.S.) encompass Mathematics, Statistics, Applied Mathematics, and Engineering Mathematics, and are designed so that students can have the opportunity to prepare for employment immediately upon graduation or for continuing with graduate studies in any of these areas.

The undergraduate Physics program offers a basic foundation in classical and modern physics for students interested in professional careers in physics, usually requiring graduate degrees, as well as in related fields, e.g., electrical engineering, medical physics, radiology, lasers, geophysics, computer science (B.S.), or a strong base in physics for students seeking to pursue careers in medicine, patent law, government or industrial laboratories, or secondary school teaching (B.A.).

The School of Natural Sciences and Mathematics also provides opportunities for students to complete Texas Teacher Certification requirements in Biology, Chemistry, Earth Science, Life/Earth Science, Mathematics, and Physics. Students who wish to be certified should consult the Teacher Development Center for specific requirements as soon as possible after formal admission to the University. Further details may be found in the Teacher Education section of the catalog.

Chemistry (B.A., B.S.)

The Chemistry major builds on a base of chemistry, physics, mathematics, and computer science to provide the student the opportunity to develop essential theoretical and practical skills in the subdisciplines of organic, physical, inorganic, analytical, and macromolecular chemistry. Typically, the practice of chemistry in industry deals with the synthesis, analysis, and control of the many materials used in our technological society.

The Chemistry program at U.T. Dallas is designed to instruct the student in how chemical experiments are performed, how results are interpreted, and through its integrated laboratory sequence, to emphasize the importance of one subdiscipline in solving problems inherent to another. Meeting these goals, the Chemistry program provides the student with the flexibility to enter industry, go on to graduate school, or pursue medical, dental, and other degrees in the health sciences.

Degrees
The Chemistry major may choose a program leading either to the B.A. or B.S. degree. The latter degree sequence has been approved by the American Chemical Society's Committee on Professional Training.

**B.A. Program**

The B.A. program offers the minimum fundamental knowledge required for adequate professional function in a career in chemistry. It is possible that students choosing this option may, through suitable use of unspecified hours, prepare for careers in areas as varied as chemistry-related businesses, government, medicine and dentistry, secondary school teaching, and even law or politics.

**B.S. Program**

The B.S. program provides more intensive training in chemistry for the student who intends either to obtain employment at the bachelor's level in the chemical industry or to pursue graduate study.

**Bachelor of Arts or Bachelor of Science in Chemistry Degree Requirements (B.S. 123 hours; B.A. 122 hours)**

I. Core Curriculum Requirements\(^1\): 42 hours

- **A. Communication (6 hours)**
  - 3 hours Communication (RHET 1302)
  - 3 hours Communication Elective (NATS 4310)\(^2\)
- **B. Social and Behavioral Sciences (15 hours)**
  - 6 hours Government (GOVT 2301 and 2302)
  - 6 hours History (HST 1301 and 2301)
  - 3 hours Social and Behavioral Sciences Elective
- **C. Humanities and Fine Arts (6 hours)**
  - 3 hours Fine Arts (AP 1301)
  - 3 hours Humanities (A&H 1301)
- **D. Mathematics and Quantitative Reasoning (6 hours)**
  - 6 hours Calculus (MATH 2417 and 2419)\(^2,3\)
- **E. Science (9 hours)**
  - Introductory Chemistry (CHM 1311, 1111, 1312, 1112, and 2401)\(^3\)

\(^1\) Curriculum Requirements can be fulfilled by other approved courses from accredited institutions of higher education. The courses listed in parentheses are recommended as the most efficient way to satisfy both Core Curriculum and Major Requirements at U.T. Dallas.

II. Major Requirements: B.S. 58 hours; B.A. 57 hours

Major Preparatory Courses (29 hours beyond the Core Curriculum)

- MATH 2417 Calculus I\(^3\)
- MATH 2419 Calculus II\(^3\)
- CHM 1311\(^+\) General Chemistry I\(^2,3\)
- CHM 1111\(^+\) Chemistry Lab I\(^2,3\)
- CHM 1312\(^+\) General Chemistry II\(^2,3\)
- CHM 1112\(^+\) Chemistry Lab II\(^2,3\)
- CHM 2401\(^+\) Introductory Quantitative Methods in Chemistry\(^2,3\)
- CHM 2323\(^+\) Organic Chemistry I
CHM 2123* Organic Chemistry Lab I  
CHM 2325* Organic Chemistry II  
CHM 2225* Organic Chemistry II Lab  
MATH 2421 Multivariable Calculus  
CS 1315 Computer Science I  
PHYS 2325 Mechanics and Heat  
PHYS 2125 Physics Lab I  
PHYS 2326 Electromagnetism and Waves  
PHYS 2126 Physics Lab II  

Major Core Courses (12 hours)  
CHM 3411 Physical Chemistry I  
CHM 3471 Advanced Synthesis Laboratory  
CHM 3472 Instrumental Analysis  

Major Related Courses (B.S. 22 hours; B.A. 21 hours)  
Bachelor of Arts (18 hours beyond the Core Curriculum)  
CHM 3341 Inorganic Chemistry I or CHM 3312 Physical Chemistry II  
CHM 3361 Biochemistry I or CHM 4335 Polymer Chemistry  
Guided Electives - 12 credit hours; may be used in (partial) fulfillment of a Second Major, Minor or Teaching Certificate  
Advanced Writing NATS 4310 Technical Writing²  

Bachelor of Science (19 hours beyond the Core Curriculum)  
CHM 3341 Inorganic Chemistry I  
CHM 3312 Physical Chemistry II  
CHM 3361 Biochemistry  
CHM 4473 Physical Measurements Laboratory  
CHM 4V91 (6 hours) Research in Chemistry (includes Advanced Writing) ²,⁴  
Any upper-division Chemistry elective (3 hours) not taken to fulfill above  

² A required Major course that also fulfills Core Curriculum requirements. If hours are counted in the Core Curriculum, students must complete additional coursework to meet the minimum requirement for graduation. Course selection assistance is available from the undergraduate advisor.  
³ Hours above the Core Curriculum requirement are counted as part of the Major Preparatory Courses.  
⁴ Research in Chemistry (CHM 4291 - 4691) is better defined as a project than a course and constitutes an important part of the B. S. degree. The student conducts original research under the supervision of a faculty member, then must submit a research report which is defended orally. Normally this project will span two or more semesters. A complete set of guidelines is available from the undergraduate advisor.  
* Indicates course requirements satisfied upon successful completion of the Honors Chemistry Sequence 1315+1215+1316+1216  
+ Indicates a prerequisite class to be completed before enrolling for upper division classes.  

III. Elective Requirements: 18 hours  
Advanced Electives (6 hours)  
These courses must be outside the major and be upper-division and/or have prerequisites.  
Free Electives (12 hours)  
The plan must include sufficient upper-division credit to total 51 upper-division credit hours.  

Minor in Chemistry  
18 hours that must include  
CHM 3161 Biochemistry Lab  
CHM 3361 Biochemistry I  
CHM 3411 Physical Chemistry I  
CHM 3471 Instrumental Analysis
Fast Track Baccalaureate/Master's Degrees

Undergraduate students at U.T. Dallas with strong academic records who intend to pursue the M.S. in Chemistry at U.T. Dallas may apply for a Fast Track plan of study which involves taking selected graduate courses as an upper-level student. After admission to the graduate program, 15 hours of graduate courses with an earned grade of B or better can be used toward completion of the bachelor's degree and to satisfy requirements for the master's degree. Interested students should contact the undergraduate advisor well in advance of the junior year to prepare a sequence permitting maximal advantage to be taken of the catalog's regulations (see page 68) regarding Undergraduate Registration for Graduate Courses.

Specified Course Descriptions

A&H 1301 (HUMA 1301) Exploration of the Humanities (3 semester hours) An introduction to the concept of cultural tradition through the study of selected works of literature, philosophy, music, and visual art. Emphasis on the relations among various forms of cultural expression and developing students' ability to interpret complex artistic works in their historical, cultural, and intellectual contexts. General education core course. (3-0) S

AP 1301 (ARTS 1301) Exploration of the Arts (3 semester hours) This course introduces students to the physical and intellectual demands required of the author, the performer, and the visual artist. This introduction includes, but is not limited to, the student's production of a creative project as well as written assessments of art and performance. (3-0) Y

CHM 1111 (CHEM 1111) General Chemistry Laboratory I (1 semester hour) Introduction to the chemistry laboratory. Experiments are designed to demonstrate concepts covered in CHM 1311; including properties and reactions of inorganic substances, and elementary qualitative and quantitative analysis. (0-3) S

CHM 1112 General Chemistry Laboratory II (1 semester hour) A continuation of CHM 1111 demonstrating the concepts covered in CHM 1312, including acid-base chemistry, reaction kinetics, electrochemistry, polymers, and organic synthesis. Prerequisite: CHM 1111 or 1215. (0-3) S

CHM 1311 (CHEM 1311) General Chemistry I (3 semester hours) Introduction to elementary concepts of chemistry theory. The course emphasizes chemical reactions, the mole concept and its applications, and molecular structure and bonding. (3-0) S

CHM 1312 (CHEM 1312) General Chemistry II (3 semester hours) A continuation of CHM 1311 treating metals; solids, liquids, and intermolecular forces; chemical equilibrium; electrochemistry; organic chemistry; rates of reactions; and environmental, polymer, nuclear, and biochemical. Prerequisite: CHM 1311 or 1315. (3-0) S

CHM 2123 (CHEM 2123) Introductory Organic Chemistry Laboratory I (1 semester hour) The experimental skills associated with organic functional group reactions. Prerequisite: CHM 2323 (may be taken concurrently). (0-4) S

CHM 2225 (CHEM 2225) Introductory Organic Chemistry Laboratory II (2 semester hours) Continuation of Organic Chemistry Laboratory I. Prerequisites: CHM 2323 and 2123; corequisite: CHM 2325. (0-8) S

CHM 2323 (CHEM 2323) Introductory Organic Chemistry I (3 semester hours) The covalent bond. Organic chemistry: aliphatic and aromatic compounds; covalent inorganic and organometallic compounds; a survey of the organic functional groups and their typical reactions; stereochemistry. The first course in organic chemistry. Satisfies the basic organic chemistry lecture requirements for pre-health profession students. Prerequisite: CHM 1312 or 1316. (3-0) S


CHM 2401 (CHEM 2401) Introductory Quantitative Methods in Chemistry (4 semester hours) A study of the theory, applications, and calculations involved in the methods of analysis. Theory and practice of volumetric, gravimetric, and spectrophotometric methods. CHM 2401 may not be taken for credit by students who have completed successfully CHM 1316. Prerequisites: CHM 1312 and 1112. (2-6) Y

CHM 3312 Physical Chemistry II (3 semester hours) Fundamental microscopic properties of matter and radiation are discussed. A core of topics including quantum chemistry, atomic and molecular structure and spectroscopy, and statistical mechanics is supplemented with topics germane to the wide variety of students taking physical chemistry. Such additional
topics might include nuclear magnetic resonance, symmetry, photochemistry, crystals, or macromolecules. Prerequisite: CHM 3411 or consent of instructor. (3-0) Y

CHM 3341 Inorganic Chemistry I (3 semester hours) Survey of inorganic chemistry with emphasis on the modern concepts and theories of inorganic chemistry including electronic and geometric structure of inorganic compounds. Topics address contemporary physical and descriptive inorganic chemistry. (3-0) Y

CHM 3361 Biochemistry I (3 semester hours) Structures and chemical properties of amino acids; protein purification and characterization; protein structure and thermodynamics of polypeptide chain folding; catalytic mechanisms, kinetics, and regulation of enzymes; energetics of biochemical reactions; carbohydrate structure and metabolism; the citric acid cycle, electron transport mechanisms and oxidative phosphorylation. Prerequisites: CHM 2323 and 2325, or equivalent. (Same as BIO 3361.) (3-0) Y

CHM 3411 Physical Chemistry I (4 semester hours) Fundamental properties of macroscopic physical and chemical systems are introduced and described in quantitative terms. A core of topics in thermodynamics (first, second, third law; chemical and phase equilibria) and chemical kinetics is supplemented with topics germane to the wide variety of students taking physical chemistry. Prerequisites: CHM 2325 and 2225, and MATH 2421, or consent of instructor. (4-0) Y

CHM 3471 Advanced Chemical Synthesis Laboratory (4 semester hours) Careful handling practices and controlled variation of reaction parameters to obtain high yield syntheses. Use of standard separation techniques and spectrophotometric methods to identify reaction products and assess their purity. Prerequisite: CHM 2225 or consent of instructor. (1-7) Y

CHM 3472 Instrumental Analysis (4 semester hours) Basic processes, instrumentation and applications of ultraviolet, visible, fluorescence, atomic and mass spectroscopy, electrochemistry, surface and microanalysis, and separations. Emphasis will be placed upon acquisition, treatment, and interpretation of data and report writing. Prerequisite: CHM 2401. (2-6) Y

CHM 4335 Polymer Chemistry (3 semester hours) Macromolecules. Synthesis, structure, and properties of polymers. Polymer-polymer and polymer-solvent interactions. Applications in industry and biochemistry. Prerequisite: CHM 3411 or consent of instructor. (CHM 3312 recommended.) (3-0) Y

CHM 4473 Physical Measurements Laboratory (3 semester hours) Thermodynamics and physical properties of matter, vacuum techniques, kinetics, basic operations in electronics, literature skills, and use of computers. Prerequisites: CHM 3472 and CHM 3312, or consent of instructor. (1-7) Y

CHM 4V91 Research in Chemistry (2-6 semester hours) Students will pursue an independent project under the supervision of a member of the Chemistry faculty. Prerequisites: Consent of supervising faculty and filing a research plan approved by supervising faculty and the Undergraduate Committee in Chemistry prior to the 12th class day. This course satisfies the university advanced writing requirement. (2-6) S

CS 1315 (COSC 1315) Computer Science I (3 semester hours) Computer programming in a high-level, block structured language. Algorithmic thinking and the history and utility of machines which automate it. Basic data types and variables, memory usage, control structures (sequential, selection, repetition), functions and parameter passing, recursion, console and file input/output. Prerequisite: Basic computer literacy/programming skills (see CS 1115 description) or concurrent enrollment in CS 1115. (3-0) S

GOVT 2301 (GOVT 2305) Constitutional Foundations and Political Behavior in the U.S. and Texas (3 semester hours) This course examines the evolution and current state of political behavior and public policy making in the U.S. and Texas. Topics discussed will include the constitutions, federalism, intergovernmental relations, voting, elections, political parties, public opinion, and interest groups. (Fulfills one-half of the legislative requirement of 6 hours of American government.) (3-0) S

GOVT 2302 (GOVT 2306) Political Institutions in the U.S. and Texas (3 semester hours) This course explores the primary institutions of U.S. and Texas government. It examines the bureaucracy as well as the executive, legislative, and judicial branches of government at the state and federal level. (Fulfills one-half of the legislative requirement of 6 hours of American government.) (3-0) S

HST 1301 Themes and Ideas in American History (3 semester hours) An introduction to the methods of historical inquiry through the study of selected main themes in American history. A course designed to offer students an understanding of the historical and cultural context of America in the contemporary world. Fulfills one-half of the Texas legislative requirement for six hours in American history. (3-0) S
HST 2301 Issues in American History (3 semester hours) Readings, commentary, and discussion aimed at varying aspects of history and culture. Fulfills one-half of the Texas legislative requirement for six hours in American history. (3-0) Y

MATH 2417 (MATH 2417) Calculus I (4 semester hours) Functions, limits, continuity, differentiation; integration of function of one variable; logarithmic, exponential, and inverse trigonometric functions; techniques of integration, and applications. Three lecture hours and two discussion hours a week. Prerequisite: MATH 2312 or equivalent. (4-0) S

MATH 2419 Calculus II (MATH 2419) (4 semester hours) Continuation of MATH 2417. Improper integrals, sequences, infinite series, power series, parametric equations and polar coordinates, vectors, vector-valued functions, functions of several variables, partial derivatives and applications, multiple integration. Three lecture hours and two discussion hours a week. Prerequisite: MATH 2417. (4-0) S

MATH 2421 Multivariable Calculus with Applications (4 semester hours) Vectors, matrices, vector functions, partial derivatives, divergence, curl, Laplacian, multiple integrals, line and surface integrals, Green's, Stoke's, and Gauss's theorems, and applications in physical sciences and engineering. Three lecture hours and two discussion hours per week. Prerequisite: MATH 2419. (4-0) S

NATS 4310 Advanced Writing in the Natural Sciences and Mathematics (3 semester hours) A writing-intensive course on questions or problems in natural sciences and mathematics; satisfies the advanced writing requirement for graduation. (3-0) S

PHYS 2125 (PHYS 2125) Physics Laboratory I (1 semester hour) Laboratory course to accompany PHYS 2325. Personal computer-based data presentation and curve fitting. Basic measurement concepts such as experimental uncertainty, mean, standard deviation, standard error, and error propagation will be covered. Corequisite: PHYS 2325. (0-3) Y

PHYS 2126 (PHYS 2126) Physics Laboratory II (1 semester hour) Laboratory course to accompany PHYS 2326. Builds on concepts of Physics Lab I. Will emphasize the use of an oscilloscope and measurements using simple circuits constructed in class. Corequisite: PHYS 2326. (0-3) Y

PHYS 2325 (PHYS 2325) Mechanics and Heat (3 semester hours) Calculus based. Basic physics including a study of space and time, kinematics, forces, energy and momentum, conservation laws, rotational motion, torques, harmonic oscillation, temperature and heat. Two lectures and one recitation session per week. Prerequisite: MATH 2417. Corequisite: PHYS 2125. (3-0) Y

PHYS 2326 (PHYS 2326) Electromagnetism and Waves (3 semester hours) Continuation of PHYS 2325. Topics include electrostatics and electromagnetics, electric field and potential, electric currents, magnetic fields, laws of Coulomb, Ampere, and Faraday, Maxwell's theory of propagation and optics. Two lectures and one recitation session per week. Prerequisites: PHYS 2325 and MATH 2419. Corequisite: PHYS 2126. (3-0) Y

RHET 1302 (ENGL 1302) Rhetoric (3 semester hours) The course presents an integrated approach to writing, reading, and critical thinking by developing the grammatical, logical, and rhetorical skills necessary for university writing. All classes work in a computerized learning environment. Students are taught basic computer literacy and submit all work electronically and on paper. (3-0) S