

CHEMISTRY (CHE)

NOTE: All prerequisites for Chemistry (CHE) courses must be completed with a grade of "C-" or better.

Laboratory Course Policy: Space in laboratory courses is limited. To ensure the best possible service to all students, failure to attend the first laboratory and lecture sessions associated with a laboratory course may result in administrative removal from the course.

Chemistry (CHE) Courses

CHE 1004. Chemistry for Allied Health Sciences. (3-3) 4 Credit Hours. (TCCN = CHEM 1405)

Introduction to atomic structure, chemical bonding, stoichiometry, states of matter, inorganic chemical reactions, and acids and bases. The course has a laboratory component to introduce general chemical laboratory techniques, principles, and methods to reinforce lecture topics. For majors in occupational therapy, pre-nursing, and dental hygiene. May not be applied to a major or minor in chemistry, biology, or clinical laboratory sciences. (Formerly CHE 1003 and CHE 1011. CHE 1083 cannot be taken as a substitution for CHE 1004. Credit can only be earned for one of the following: CHE 1003, CHE 1011, CHE 1083, or CHE 1004.) Generally offered: Fall and Spring. Course Fees: IUC1 \$15; L001 \$30; LRS1 \$61.60; STSI \$28.80.

CHE 1014. Elementary Organic and Biochemistry. (3-3) 4 Credit Hours. (TCCN = CHEM 1407)

Prerequisite: A grade of "C-" or better in CHE 1004. A survey of the structures and reactions of some important functional groups of organic chemistry, and the relationship of these functional groups to the chemistry of lipids, carbohydrates, nucleic acids, and proteins. May not be applied to a major or minor in chemistry. Laboratory examination of the properties of some simple organic and biological chemicals; topics include solubility, crystallization, organic reactions, titration, enzyme action, sugars, and vitamins which will directly reinforce lecture topics. (Formerly CHE 1013 and CHE 1203. CHE 1093 cannot be taken as a substitution for CHE 1014. Credit can be earned for only ONE of the following: CHE 1013, CHE 1014, CHE 1093, or CHE 1203.) Generally offered: Spring. Course Fees: IUC1 \$15; L001 \$30; LRS1 \$61.60; STSI \$28.80; DL01 \$100.

CHE 1073. Basic Chemistry. (3-0) 3 Credit Hours.

A preparatory class for CHE 1103. This course focuses on traditionally difficult concepts encountered in CHE 1103. Topics include, but are not limited to, dimensional analysis, significant figures, inorganic nomenclature, and qualitative and quantitative analyses of basic chemical reactions. May not be applied to a B.S. or B.A. in Chemistry nor to the B.S. in Biochemistry. Generally offered: Fall, Spring, Summer. Course Fees: LRS1 \$46.20; STSI \$21.60; DL01 \$75.

CHE 1083. Introduction to the Molecular Structure of Matter. (3-0) 3 Credit Hours.

This course is an introduction to the structure of matter, with a focus on the molecules of carbon that comprise living systems. Topics include covalent and ionic bonding, molecular structure, shape, and stability, isomers, organic functional groups and charge distribution in molecules, and bonding in solids. May be applied toward the Core Curriculum requirement in Life and Physical Sciences. (CHE 1004 cannot be taken as a substitution for CHE 1083, credit cannot be earned for both courses.) Course Fee: LRC1 \$12; LRS1 \$46.20; STSI \$21.60; DL01 \$75.

CHE 1093. Introduction to Molecular Transformations. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 1083 and in MAT 1073 or higher. This course is an introduction to chemical reactions, with a focus on basic organic and inorganic reactions that take place in the environment. Topics include classification of reactions, stoichiometry, reaction energetics, chemical equilibrium, acid-base chemistry, complex equilibria and reaction kinetics. May be applied toward the Core Curriculum requirement in Life and Physical Sciences. (CHE 1014 cannot be taken as a substitution for CHE 1093, credit cannot be earned for both courses.) Course Fee: DL01 \$75; LRC1 \$12; LRS1 \$46.20; STSI \$21.60.

CHE 1103. General Chemistry I. (3-0) 3 Credit Hours. (TCCN = CHEM 1311)

Prerequisite: AP Chemistry Score of 3 or greater, or a grade of "C-" or better in CHE 1073, or above 70% mastery in the ALEKS Chemistry assessment; concurrent enrollment in CHE 1121 is recommended. An introduction to descriptive inorganic chemistry and atomic-molecular structure, including such fundamental concepts as the periodic system of elements, valency, chemical bonding, reactions and reaction mechanisms, stoichiometry, equilibria, acids and bases, thermochemistry, molecular-kinetic theory, dimensional analysis, and states of matter. Generally offered: Fall, Spring, Summer. Course Fee: LRS1 \$46.20; STSI \$21.60; DL01 \$75.

CHE 1113. General Chemistry II. (3-0) 3 Credit Hours. (TCCN = CHEM 1312)

Prerequisite: A grade of "C-" or better in CHE 1103 or the equivalent. A continuation of CHE 1103. Elementary inorganic and physical chemistry; topics include states of matter, solutions, electrolytes, oxidation-reduction reactions, reaction trends, coordination chemistry, basic thermodynamics, chemical kinetics, electrochemistry, acid-base chemistry, and nuclear chemistry. Primarily for science majors. Generally offered: Fall, Spring, Summer. Course Fee: LRS1 \$46.20; STSI \$21.60; DL01 \$75.

CHE 1121. General Chemistry I Laboratory. (1-4) 1 Credit Hour. (TCCN = CHEM 1111)

Prerequisite: A grade of "C-" or better in CHE 1103 or concurrent enrollment in CHE 1103. An introduction to chemical problem solving and the basic operations of the chemical laboratory, chemical writing, and a survey of inorganic chemical reactions. This course consists of problem sessions, lecture-demonstrations, and/or laboratory experience. Laboratory to accompany CHE 1103. This laboratory includes a lecture component. Generally offered: Fall, Spring, Summer. Course Fee: IUC1 \$15; L001 \$30; LRS1 \$15.40; STSI \$7.20; DL01 \$25.

CHE 1131. General Chemistry II Laboratory. (1-4) 1 Credit Hour. (TCCN = CHEM 1112)

Prerequisite: A grade of "C-" or better in CHE 1103 and CHE 1121, and a grade of "C-" or better or concurrent enrollment in CHE 1113. Techniques of qualitative and quantitative chemical analysis illustrated primarily via inorganic chemical systems, their reactions, and chemical writing. Laboratory to accompany CHE 1113. This laboratory includes a lecture component. Generally offered: Fall, Spring, Summer. Course Fee: IUC1 \$15; L001 \$30; LRS1 \$15.40; STSI \$7.20; DL01 \$25.

CHE 2214. Analytical Chemistry. (2-6) 4 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 1113 and CHE 1131. Topics in quantitative chemical analysis based on the concepts of the analytical process, calibration plot, standard addition, internal standard, stoichiometry, concentration, chemical equilibrium, titration, solubility, acid-base chemistry, complexation, oxidation/reduction, voltaic/electrolytic cells, light absorption, chemical separations, and statistical error analysis (lecture and laboratory). Formerly CHE 3214. Credit cannot be earned for both CHE 3214 and CHE 2214. General offered: Fall, Spring. Differential tuition: \$200. Course Fee: IUC1 \$15; L001 \$30.

CHE 2603. Organic Chemistry I. (3-0) 3 Credit Hours. (TCCN = CHEM 2323)

Prerequisite: A grade of "C-" or better in CHE 1113. A study of the fundamentals of organic chemistry including structure, reaction mechanisms, synthesis, and spectroscopy. Discussion and problems amplify and clarify the course topics. (Same as CHE 2703. Credit cannot be earned for more than one of the following: CHE 2603 or CHE 2703.) Generally offered: Fall, Spring, Summer. Course Fee: LRS1 \$46.20; STSI \$21.60; DL01 \$75.

CHE 2612. Organic Chemistry I Laboratory. (1-4) 2 Credit Hours.

Prerequisites: A grade of "C-" or better, or concurrent enrollment, in CHE 1131 and CHE 2603. The first of two semesters of organic chemistry laboratory. Qualitative analysis and determination of the physical constants of organic compounds. Separation, identification, and elementary synthesis of organic compounds. Laboratory techniques—crystallization, distillation, chromatographic and spectroscopic techniques (IR, NMR, MS)—are emphasized. This laboratory includes a lecture component. Generally offered: Fall, Spring, Summer. Course Fees: IUC1 \$15; L001 \$30; LRS1 \$30.80; STSI \$14.40; DL01 \$50.

CHE 3464. Descriptive Inorganic Chemistry. (3-3) 4 Credit Hours.

Prerequisites: A grade of "C-" or better in CHE 1113 and CHE 1131. The basic principles of inorganic chemistry applied to the properties, reactions, and periodicity of inorganic elements and compounds. Includes the synthesis and characterization of inorganic compounds, and the use of specialized laboratory techniques. Generally offered: Spring. This course has Differential Tuition. Course Fees: IUC1 \$15; L001 \$30.

CHE 3643. Organic Chemistry II. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 2603 (or CHE 2703 in previous catalogs). Continuing study of fundamentals of organic structure, reaction mechanisms, synthesis, and spectroscopy. A continuation of CHE 2603. Credit cannot be earned for both CHE 3703 and CHE 3643. Generally offered: Fall, Spring, Summer. This course has Differential Tuition.

CHE 3652. Organic Chemistry II Laboratory. (1-4) 2 Credit Hours.

Prerequisites: Grades of "C-" or better in CHE 2603 (or CHE 2703 in previous catalogs), and CHE 2612. Quantitative and continuing qualitative study of organic reactions and molecular structure through functional group interactions and spectroscopic techniques. Simple and multistep syntheses of organic compounds. A continuation of CHE 2612. This laboratory includes a lecture component. Generally offered: Fall, Spring, Summer. This course has Differential Tuition. Course Fees: IUC1 \$15; L001 \$30; DL01 \$50.

CHE 3804. Molecular Thermodynamics. (4-0) 4 Credit Hours.

Prerequisites: A grade of "C-" or better in CHE 1113, MAT 1223 (MAT 1224 in previous catalogs), and PHY 1963. The laws of thermodynamics, free energy and chemical potential, ideal and non-ideal gases, phase transitions, equilibria, solutions, and kinetic theory of gases. Mathematical methods and concepts related to the study of thermodynamics. (Formerly titled "Physical Chemistry I and Laboratory.") Generally offered: Fall. This course has Differential Tuition. Course Fees: IUC1 \$15; L001 \$30; DL01 \$100.

CHE 3812. Physical Chemistry Laboratory. (0-6) 2 Credit Hours.

Prerequisites: A grade of "C-" or better in CHE 1113, CHE 1131, CHE 3804 or CHE 3824, PHY 1963, and PHY 1971. Laboratory study of selected physicochemical principles and methods illustrating concepts developed in CHE 3804 and CHE 3824. Data acquisition, data analysis, and report writing are stressed. Generally offered: Spring. This course has Differential Tuition. Course Fees: IUC1 \$15; L001 \$30.

CHE 3824. Quantum Chemistry and Spectroscopy. (4-0) 4 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 1113, MAT 1223 (or MAT 1224 in previous catalogs), and PHY 1963. Introduction to atomic and molecular quantum chemistry, group theory, and electronic, rotational, vibrational, and electronic spectroscopies. Mathematical methods and concepts related to quantum theory and molecular spectroscopy. (Formerly titled "Physical Chemistry II and Laboratory.") Generally offered: Spring. This course has Differential Tuition. Course Fee: IUC1 \$15; L001 \$30; DL01 \$100.

CHE 3973. Chemical Communications. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3643 and CHE 3652. Introduction to communication techniques used in the chemistry profession, including writing résumés and proposals, researching topics in the chemical literature, review and analysis of articles and other scientific materials, and oral presentation of chemical research. Same as CHE 4971, credit cannot be earned for both CHE 3973 and CHE 4971. Generally offered: Fall, Spring. This course has Differential Tuition.

CHE 4213. Instrumental Analysis. (2-5) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 2214 and CHE 3652, and a grade of "C-" or better or concurrent enrollment in CHE 3824. The physical and chemical principles of modern instrumental techniques used for chemical analysis. Topics include emission, absorption, magnetic resonance, FTIR spectroscopies, mass spectrometry, and chromatography. The use of spectrometric and chromatographic instrumentation in the separation, identification, and quantitation of compounds in chemical systems. Generally offered: Spring. This course has Differential Tuition. Course Fee: IUC1 \$15; L001 \$30.

CHE 4273. Forensic Chemistry. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 2214, CHE 3652, and CHE 3804 or CHE 4354 (formerly CHE 3854). Application of chemical analyses with real world and legal implications. Topics include statistics, sample handling and preparation, analysis of drugs, combustion products, inks and paints, and colors and colorants. The use of spectrometric and chromatographic instrumentation in the separation, identification, and quantitation of compounds in chemical systems will be developed. This course has Differential Tuition.

CHE 4354. Biophysical Chemistry. (3-3) 4 Credit Hours.

Prerequisite: A grade of "C-" or better in BCH 3313 (or CHE 3313 in previous catalogs), CHE 3643, MAT 1213 (or MAT 1214 in previous catalogs), PHY 1963 or PHY 1623, and PHY 1971 or PHY 1631. Fundamental aspects of the physical principles that drive biological processes, particularly as applied to proteins. Topics covered include protein structure, molecular thermodynamics, structure simulation, basic statistical mechanics, quantum mechanics, and spectroscopy. This course cannot be used as an upper-division chemistry elective by students pursuing a B.S. in Chemistry. Formerly CHE 3854. Credit cannot be earned for both CHE 4354 and CHE 3854. Generally offered: Spring. This course has Differential Tuition. Course Fee: IUC1 \$15; L001 \$30.

CHE 4443. Green Chemistry. (3-0) 3 Credit Hours.

Prerequisites: A grade of "C-" or better in CHE 3464 and CHE 3643, or consent of instructor. Overview of the 12 principles of green chemistry, the chemical tools utilized, and relevant examples of their practical use in commercial applications. The focus is on sustainability ethics and the primary challenges in green chemistry, including development and hazards to health and the environment. This course has Differential Tuition.

CHE 4463. Inorganic Chemistry. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3464, and completion of or concurrent enrollment in CHE 3804 or CHE 4354 (formerly CHE 3854). A study of the structure, bonding, and properties of inorganic compounds, acid-base theory, crystalline state, coordination chemistry, and other advanced topics. Generally offered: Fall. This course has Differential Tuition.

CHE 4483. Solid State Chemistry. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 1113. An introduction to inorganic materials and solid state chemistry for graduate students and advanced undergraduate students. The focus is on understanding solid state materials from a structural and chemical perspective and introducing general solid state synthesis methodologies and characterization techniques. This course has Differential Tuition.

CHE 4513. X-Ray Crystallography. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3464 or consent of instructor. Topics include a physical description of the crystalline state, symmetry in crystals, X-ray diffraction, modern methods of structural determination, crystallographic software and databases, and chemical interpretation of structural results. This course has Differential Tuition.

CHE 4613. Introduction to Polymer Chemistry. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3643. Introduction to principles of polymer chemistry. Molecular weight analysis, solution properties, structure-property relationships, mechanical and chemical properties, polymer synthesis, conducting polymers, biopolymers, and applications of polymers. Generally offered: Spring. This course has Differential Tuition.

CHE 4643. Advanced Topics in Organic Chemistry. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3643. This course prepares students for graduate study in organic chemistry. Topics include physical organic chemistry, molecular orbital theory, transition state theory, hard soft acid-base theory, organometallics, and catalysis. This course has Differential Tuition.

CHE 4683. Photochemistry. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3643. Principles of the interaction of light with molecular, polymer, and materials systems. Photophysical processes including light absorption, emission, and excited state kinetics. Mechanisms of organic and inorganic molecular photoreactions. Applications of photo processes including photocatalysis, solar cells, photochromism, and light-emitting diodes. This course has Differential Tuition.

CHE 4703. Drug Metabolism. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3643 or consent of the instructor. This course covers how drugs are metabolized in the body, including the mechanisms for enzyme-catalyzed reactions, with an emphasis on how to propose and experimentally test various hypotheses. This course has Differential Tuition.

CHE 4723. Pharmaceutical Chemistry. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3643. Exploration of the process of drug discovery and development with particular emphasis on the role of organic chemistry. Topics include the design of new drugs, their interaction with biological targets, the application of medicinal chemistry in lead optimization, and large-scale drug synthesis and development. This course has Differential Tuition.

CHE 4753. NMR Spectroscopy. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3643. Introduction to the techniques of ^1H , ^{13}C , and multinuclear NMR spectroscopy for structure elucidation in organic chemistry. Topics include the principles of NMR spectroscopy and the role of chemical shift, coupling constants, and splitting patterns. Multi-pulse experiments and 2-dimensional techniques are also discussed. Generally offered: Spring. This course has Differential Tuition.

CHE 4763. Medicinal Chemistry. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3643 and in BCH 3313 (or CHE 3313 in previous catalogs). Application of the principles of organic chemistry to medicinal studies, including drug discovery and design, drug synthesis, and chemical interactions in living systems. This course has Differential Tuition.

CHE 4773. Advanced Catalysis. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3643 and CHE 3464. Advanced topics in chemical catalysis and its application to the organic synthesis of complex molecules. Systems studied include important traditional catalytic processes and new methods introduced in the recent scientific literature. This course has Differential Tuition.

CHE 4823. Chemical Kinetics and Dynamics. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3804, and either MAT 1223 (or MAT 1224 in previous catalogs) or PHY 1963, or consent of the instructor. Mechanism and rate of chemical reactions from a fundamental point of view, the nature of collisions including cross section and rate constant, and theories of elementary bimolecular and decay processes. The course examines different rate laws, the method of steady-state approximation, and its application to chemical reactions. This course has Differential Tuition.

CHE 4853. Computational Chemistry. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3824 or consent of instructor. The application of molecular mechanical, molecular orbital, and density functional methods to problems of molecular structure, property, reactivity, and spectroscopy. Generally offered: Summer. This course has Differential Tuition.

CHE 4883. Introduction to Mass Spectrometry. (2-3) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3804 or CHE 4354, or consent of instructor. The basic principles of interpreting mass spectra and how they are produced. The effect the method of ion production has on the observed mass spectra, and the theory and operation of several types of mass spectrometers will be covered. The basic theory of ion-molecule reactions and principles and practice of biological mass spectrometry and other advanced topics will be presented. This course has Differential Tuition. Course Fee: IUC1 \$15; L001 \$30.

CHE 4911. Independent Study. (0-0) 1 Credit Hour.

Prerequisite: Approval from the instructor, the Department Chair, and the Associate Dean of Undergraduate Studies in the College for which this course is offered; the registration form is available on the UTSA OneStop website. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but no more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. This course has Differential Tuition.

CHE 4912. Independent Study. (0-0) 2 Credit Hours.

Prerequisite: Approval from the instructor, the Department Chair, and the Associate Dean of Undergraduate Studies in the College for which this course is offered; registration form available on the UTSA OneStop website. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but no more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. This course has Differential Tuition.

CHE 4913. Independent Study. (0-0) 3 Credit Hours.

Prerequisite: Approval from the instructor, the Department Chair, and the Associate Dean of Undergraduate Studies in the College for which this course is offered; registration form available on the UTSA OneStop website. Independent reading, research, discussion, and/or writing under the direction of a faculty member. May be repeated for credit, but no more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. This course has Differential Tuition.

CHE 4922. Special Project. (0-0) 2 Credit Hours.

Special Project in Chemistry. A special laboratory research or library readings project under the direction of a faculty member that results in a report. Limited to science majors in their final year of undergraduate study. Course may not be repeated for more than 6 hours. This course has Differential Tuition.

CHE 4923. Special Project in Chemistry. (0-0) 3 Credit Hours.

Prerequisite: Consent of Department Chair (form available in department office). A special laboratory research or library readings project under the direction of a faculty member that results in a report. Limited to science majors in their final year of undergraduate study. This course has Differential Tuition.

CHE 4933. Internship. (0-0) 3 Credit Hours.

Prerequisite: Juniors or Seniors in Academic Good Standing and approval from the employer, the instructor, the Department Chair, and the Associate Dean for Undergraduate Studies; registration form available on the College of Sciences website. The opportunity for a semester-long work experience in a private business or public agency in a position related to the student's field of study. May be repeated for credit, but no more than 6 semester credit hours of CHE 4911, CHE 4912, CHE 4913, CHE 4933, and CHE 4993, regardless of discipline, will apply to a bachelor's degree. This course has Differential Tuition.

CHE 4943. Molecular Spectroscopy. (3-0) 3 Credit Hours.

Prerequisite: A grade of "C-" or better in CHE 3824. The foundation of spectroscopic methods and the interpretation of spectra for the identification and elucidation of structures and properties of molecules will be presented. Topics include the absorption and emission of radiation, group theory, microwave, infrared, Raman, UV/Visible, and photo-electron spectroscopies. This course has Differential Tuition.

CHE 4953. Special Studies in Chemistry. (3-0) 3 Credit Hours.

Prerequisite: Upper division standing and consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Studies may be repeated for credit when the topics vary, but not more than 6 semester credit hours, regardless of discipline, will apply to a bachelor's degree. Generally offered: Fall, Spring, Summer. This course has Differential Tuition.

CHE 4993. Directed Research. (0-0) 3 Credit Hours.

Prerequisite: Approval from the instructor, the Department Chair, and the Associate Dean of Undergraduate Studies in the College for which this course is offered; form available on the College of Sciences website. Supervised research mentored by a faculty member engaged in active research within the student's designated area of concentration. Students may produce a thesis in addition to active research. May be repeated. This course can also be used for students pursuing the COS Undergraduate Thesis Option. Generally offered: Fall, Spring. This course has Differential Tuition.