

CHEMISTRY COURSE DESCRIPTIONS

Chem 101 Introduction to Chemistry (3 cr)

May be used as core credit in J-3-b. Full credit may be earned in only one of the following: [Chem 101](#), or [111](#). General treatment of the fundamentals of chemistry. Three lectures per week. Does not satisfy the prereq for [Chem 112](#).

Chem 101L Introduction to Chemistry Laboratory (1 cr)

This is the companion laboratory course to [Chem 101](#) and provides an introduction to Chemistry lab practices. It does not satisfy the lab requirement for [Chem 111](#) or [Chem 112](#). One 3-hour lab a week.

Prereq: [Chem 101](#)

Chem 111 Principles of Chemistry I (3 cr)

May be used as core credit in J-3-b. Full credit may be earned in only one of the following: [Chem 101](#), or [111](#). Note that grades in Chem 111 will supersede any grades earned in Chem 101. Intensive treatment of principles and applications of chemistry. Three lectures per week. Recommended Preparation: A grade of 'B' or better in a high school chemistry course.

Prereq: 580 SAT math or min 25 ACT math or min 46 ALEKS, or a grade of 'C' or better in [Chem 101](#), [Math 143](#), [Math 160](#), or [Math 170](#); or Permission

Chem 111L Principles of Chemistry I Laboratory (1 cr)

This is the companion laboratory course to [Chem 111](#) and provides an intensive treatment of Chemistry lab practices. One 3-hour lab a week.

Prereq: [Chem 111](#)

Chem 112 Principles of Chemistry II (4 cr)

Continuation of [Chem 111](#). Some work in inorganic chemistry, kinetics, equilibrium, liquids, solids, acid-base, electrochemistry, nuclear chemistry, thermodynamics, and qualitative inorganic analysis. Three lectures per week.

Prereq: [Chem 111](#) and [Chem 111L](#) or Permission

Chem 112L Principles of Chemistry II Laboratory (1 cr)

This is the companion laboratory course to [Chem 112](#) and teaches Chemistry lab practices in inorganic chemistry, kinetics, equilibrium, acid-base, electrochemistry, thermodynamics, and qualitative analysis. One 3-hour lab and one recitation per week.

Prereq: [Chem 112](#)

Chem 121 Glassblowing (1 cr)

Techniques used in constructing scientific apparatus from glass. Graded P/F. One 3-hr lab a wk.

Prereq: Permission of department

Chem 200 (s) Seminar (cr arr)

Chem 204 (s) Special Topics (cr arr)

Chem 253 Quantitative Analysis (3 cr)

Fundamental principles and techniques of chemical analysis; intro to sampling, standardization, data evaluation, gravimetric/volumetric methods, and instrumental techniques. (Fall only)

Prereq: [Chem 112](#)

Chem 254 Quantitative Analysis: Lab (2 cr)

Laboratory portion of Quantitative Analysis ([Chem 253](#)).

Prereq or Coreq: [Chem 253](#)

Chem 275 Carbon Compounds (3 cr)

Aspects of organic chemistry important to students in the life sciences.

Prereq: [Chem 101](#), [111](#), or Permission

Chem 276 Carbon Compounds Lab (1 cr)

Lab to accompany [Chem 275](#); for students who need only 1 cr of lab. One 3-hr lab a wk.

Prereq or Coreq: [Chem 275](#) or [277](#)

Chem 277 Organic Chemistry I (3 cr)

Principles and theories of organic chemistry; properties, preparation, and reactions of organic compounds.

Prereq: [Chem 112](#)

Chem 278 Organic Chemistry I: Lab (1 cr)

One 3-hr lab a wk.

Prereq or Coreq: [Chem 277](#)

Chem 299 (s) Directed Study (cr arr)

Chem 302 Principles of Physical Chemistry (3 cr)

Emphasis on topics important to biological and agricultural science. (Fall only)

Prereq: [Chem 112](#), [Math 160](#) or [170](#) or [175](#), and [Phys 111/111L](#), or Permission

Chem 303 Principles of Physical Chemistry Lab (1 cr)

Lab to accompany [Chem 302](#). One 3-hr lab a wk. (Fall only)

Prereq or Coreq: [Chem 302](#)

Chem 305 Physical Chemistry (3 cr)

Kinetic theory, thermodynamics, quantum mechanics, and spectroscopy. (Fall only)

Prereq: [Chem 112](#), and [Math 275](#)

Prereq or Coreq: [Phys 212](#) or [Phys 213](#)

Chem 306 Physical Chemistry (3 cr)

Kinetic theory, thermodynamics, quantum mechanics, and spectroscopy.

Prereq: [Chem 112](#), and [Math 275](#) (Spring only)

Prereq or Coreq: [Phys 212/212L](#) or [Phys 213/213L](#)

Chem 307 Physical Chemistry Lab (1 cr)

Lab to accompany [Chem 305-306](#). One 3-hr lab a wk. (Fall only)

Prereq or Coreq: [Chem 305](#)

Chem 308 Physical Chemistry Lab (1 cr)

Lab to accompany [Chem 305-306](#). One 3-hr lab a wk. (Spring only)

Prereq or Coreq: [Chem 306](#)

Chem 372 Organic Chemistry II (3 cr)

Continuation of [Chem 277](#). (Spring only)

Prereq: [Chem 277](#)

Chem 374 Organic Chemistry II: Lab (1 cr)

Lab to accompany [Chem 372](#); includes synthesis, structure determination, and mechanisms. One 3-hr lab a wk. (Spring only)

Prereq: [Chem 278](#)

Prereq or Coreq: [Chem 372](#)

Chem 400 (s) Seminar (cr arr)

Chem 404 (s) Special Topics (cr arr)

Chem 409 Proseminar (1 cr)

Current publications in chemistry and chemical engineering with reports on typical scientific papers.

Preparation of application materials for graduate work and/or careers in chemistry.

Prereq: [Chem 372](#) and junior standing

Chem J414/J514 Applications of Nanomaterials in Biomolecular Engineering (3 cr)

Interdisciplinary approach to the fundamental chemistry, physics, biology and engineering of matter and processes at the crossroads of microscopic and molecular scales; integration of the language and tools of multiple disciplines toward technological applications of nanomaterials in the life sciences and medicine.

Additional projects/assignments required for graduate credit. (Spring only)

Prereq: Senior or Graduate standing in the Colleges of Science or Engineering

Chem J418/J518 Environmental Chemistry (3 cr)

Chemistry of atmosphere, soil, and water; pollution monitoring and remediation; treatment of waste in the environment. Additional projects/assignments reqd for grad cr. (Spring only)

Prereq: [Chem 253](#), [Chem 254](#) and [Chem 275](#) or [277](#), or Permission

Chem J436/J535 Electronics for Scientists (2-4 cr, max 4)

Theory and application of analog and digital electronics used in scientific instrumentation. Registration for Chem 535 requires completion of an additional term paper or other assignment (Fall, alt/yrs).

Prereq: Permission

Chem 454 Instrumental Analysis (3-4 cr)

For students in chemistry and allied fields. Techniques in operating new and specialized instruments for qualitative and quantitative analysis and analytical methods of an advanced nature. Three lec and one 4-hr lab a wk. Permission required to register for 3 credits (Spring only)

Prereq: [Chem 253](#), [Chem 254](#), and [Chem 305](#)

Prereq or Coreq: [Chem 306](#)

Chem 455 Survey of Analytical Chemistry (3 cr)

Fundamentals of modern analytical chemistry. Open only to chemistry M.S. and Ph.D. students. Cr is not allowed in both [Chem 454](#) and [455](#).

Prereq: [Chem 306](#) and Permission

Chem 463 Inorganic Chemistry (3 cr)

Principles, complex ions and coordination compounds, theory of acids and bases, bonding theory, non-aqueous solvents, familiar elements and their relationship to the periodic table. (Fall only)

Prereq: [Chem 305](#) or Permission

Chem J464/J564 Inorganic Chemistry (3 cr)

Principles, complex ions and coordination compounds, theory of acids and bases, bonding theory, non-aqueous solvents, familiar elements and their relationship to the periodic table. Additional projects/assignments reqd for grad cr. (Spring only)

Prereq or Coreq: [Chem 463](#), or [466](#), or Permission

Chem 465 Inorganic Chemistry Laboratory (1 cr)

Lab to accompany [Chem 464](#). One 3-hr lab a wk. (Spring only)

Coreq: [Chem 464](#)

Chem 466 Survey of Inorganic Chemistry (3 cr)

Fundamentals of modern inorganic chemistry. Open only to chemistry M.S. and Ph.D. students. Cr is not allowed in both [Chem 463](#) and [466](#).

Prereq: [Chem 306](#) and Permission

Chem J472/J572 Medicinal Chemistry (3 cr)

Synthetic chemistry necessary for design and preparation of medicinal agents, and mechanistic chemistry germane to action of pharmaceuticals. Graduate students are required to write an original research proposal on a topic related to drug discovery. (Alt/yrs)

Prereq or Coreq: [Chem 473](#) or [476](#); or Permission

Chem 473 Intermediate Organic Chemistry (3 cr)

Theories and mechanisms of organic chemistry. (Fall only)

Prereq: [Chem 372](#)

Prereq or Coreq: [Chem 306](#)

Chem 476 Survey of Organic Chemistry (3 cr)

Fundamentals of modern organic chemistry. Open only to chemistry M.S. and Ph.D. students. Cr is not allowed in both [Chem 473](#) and [476](#).

Prereq: [Chem 306](#) and Permission

Chem 491 (s) Research (1-6 cr, max 12)

Submission of a report of the research done for placement in the permanent dept files is required.

Prereq: Permission of department

Chem 495 Thermodynamics and Kinetics (3 cr)

(Fall only)

Prereq: [Chem 306](#) or Equivalent

Chem 496 Survey of Physical Chemistry (3 cr)

Fundamentals of modern physical chemistry. Open only to chemistry M.S. and Ph.D. students. Cr is not allowed in both [Chem 495](#) and [496](#).

Prereq: [Chem 306](#) and Permission

Chem 498 (s) Internship (cr arr)

Chem 499 (s) Directed Study (cr arr)

Chem 500 Master's Research and Thesis (cr arr)

Chem 501 (s) Seminar (1 cr, max 2)

Chem 502 (s) Directed Study (cr arr)

Chem 504 (s) Special Topics (cr arr)

Chem 506 Introduction to Teaching and Research Skills (2 cr)

Skills required of teaching assistants in laboratory, recitations, office hours, help sessions; skills required for research; use of library; introduction to faculty research. Graded P/F. (Fall only)

Prereq: Permission

Chem 509 Advanced Physical Chemistry (3 cr)

Application of quantum theory to chemical bonding, molecular spectroscopy, and molecular structure. (Spring only)

Prereq: [Chem 306](#), 495, 496, or Permission

Chem 511 Seminar (0 cr)

Chem 514 Applications of Nanomaterials in Biomolecular Engineering (3 cr)

See [Chem J414/J514](#).

Chem 518 Environmental Chemistry (3 cr)

See [Chem J418/J518](#).

Chem 542 Biochemistry and Molecular Biology (3 cr)

See [MMBB J442/J542](#).

Chem 550 Radioanalytical Chemistry (2-3 cr, max 3)

Fundamental concepts of radiochemistry, including the principles of radioactive decay processes and counting techniques; in-depth treatment of radioanalytical techniques, especially neutron activation and isotope dilution methods; decay processes as sources of x-rays; the use of synchrotron radiation in analytical chemistry.

(Alt/yrs)

Prereq: [Chem 454](#), or [455](#), or Permission

Chem 551 Electronic Spectrometry (2-3 cr, max 3)

A brief review of fundamental concepts, including electronic transitions, optical properties of materials, and laws of radiation absorption; detailed coverage of instrumentation used for ultraviolet and visible absorption spectroscopy, with regard to optical components, overall design strategy, and signal processing; analytical performance related to these aspects and presented from both theoretical and practical standpoints; in-depth coverage of luminescence spectroscopy, including phosphorimetry and fluorimetry; atomic spectroscopy (both flame and plasma-based versions), including principles of operation, instrumental requirements, and analytical application; survey of x-ray absorption and fluorescence spectroscopy. (Alt/yrs)

Prereq: [Chem 454](#), [455](#) or Permission

Chem 552 Analytical Vibrational Spectrometry (2-3 cr, max 3)

Introduction to vibrational transitions, optical properties of materials, and laws of radiation absorption and emission (including why they are not always obeyed in practice); detailed discussion of instrumentation used for mid-infrared, near infrared, and Raman spectrometry; illustration of transmission spectrometry with examples including microscopy and spectral imaging, open-path monitoring, and spectroscopy of aqueous solutions and hyphenated techniques; introduction of time- and phase-resolved measurements; detailed coverage of specular reflection, reflection-absorption of thin films, diffuse reflection, attenuated total reflection spectrometry, and remote measurements through optical fibers; discussion of application of near infrared spectroscopy to agricultural commodity analysis and process monitoring. (Alt/yrs)

Prereq: [Chem 454](#), [455](#) or Permission

Chem 553 Separation Theory and Chromatography (2-3 cr, max 3)

Gas and liquid chromatography and related fields. Students enrolled in [Chem 553](#) are required to complete additional written assignments. (Alt/yrs)

Prereq: [Chem 306](#)

Chem 556 Molecular Spectroscopy (3 cr)

Interpretation of IR, UV, NMR, and mass spectra. Registration for [Chem 556](#) requires completion of additional assignments.

Prereq: [Chem 306](#) or Permission

Chem 558 Electrochemistry (2-3 cr, max 3)

Fundamental concepts of electrochemistry, including the principles of redox processes; in-depth treatment of electroanalytical techniques, especially voltammetric and potentiometric methods; advanced treatment of selected topics, including ultramicro and in vivo electrochemical techniques. (Alt/yrs)

Prereq: [Chem 454](#), or [455](#), or Permission

Chem 564 Inorganic Chemistry (3 cr)

See [Chem J464/J564](#).

Chem 565 (s) Topics in Inorganic Chemistry (1-9 cr, max 9)

Coordination compounds; halogens; less familiar elements; clathrate, interstitial, nonstoichiometric compounds; chemical bonding; inorganic reaction mechanisms.

Prereq: [Chem 463](#), [466](#), or Permission

Chem 567 Inorganic Spectroscopy (2-3 cr, max 3)

Applications of spectroscopic methods to investigation of inorganic and organometallic compounds; topics include multinuclear and multidimensional NMR, IR and Raman, EPR, mass spectroscopy, Mossbauer spectroscopy, and x-ray crystallography. Additional projects/assignments reqd for grad cr. (Alt/yrs)

Prereq: [Chem 306](#) and [454](#)

Chem 571 (s) Topics in Organic Chemistry (1-9 cr, max 9)

Selected topics from the current literature.

Prereq: [Chem 473](#), [476](#), or Permission

Chem 572 Medicinal Chemistry (3 cr)

See [Chem J472/J572](#).

Chem 590 Doctoral Research Proposal (1 cr)

Taken no later than one semester after completion of cumulative exams; required for advancement to Ph.D. candidacy. Includes review of relevant literature and original research proposal describing the student's intended research project.

Chem 600 Doctoral Research and Dissertation (cr arr)