

CHEMISTRY (CHEM)

Vertically-related courses in this subject field include the following:

- CHEM 111–CHEM 112–CHEM 253
- CHEM 101–CHEM 275

CHEM 101 Introduction to Chemistry (3 credits)

General Education: Natural/Integrated Science

Full credit may be earned in only one of the following: CHEM 101 or CHEM 111. General treatment of the fundamentals of chemistry. Does not satisfy the prerequisite for CHEM 112. Typically Offered: Fall and Spring.

CHEM 101L Introduction to Chemistry Laboratory (1 credit)

General Education: Natural/Integrated Science

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 per week.

Typically Offered: Fall and Spring. Prereqs or

Coreqs: CHEM 101

CHEM 111 General Chemistry I (3 credits)

General Education: Natural/Integrated Science

Full credit may be earned in only one of the following: CHEM 101, or CHEM 111. Note that grades in CHEM 111 will supersede any grades earned in CHEM 101. Intensive treatment of principles and applications of chemistry. Recommended Preparation: A grade of 'B' or better in a high school chemistry course. Typically Offered: Fall and Spring.

Prereqs: Minimum 580 SAT Math or minimum 25 ACT Math, or minimum 46 ALEKS; or a grade of 'C' or better in CHEM 101, MATH 143, MATH 160, or MATH 170; or Permission

CHEM 111L General Chemistry I Laboratory (1 credit)

General Education: Natural/Integrated Science

This is the companion laboratory course to CHEM 111 and provides an intensive treatment of Chemistry lab practices. One 3-hour lab per week.

Typically Offered: Fall and Spring. Prereqs or

Coreqs: CHEM 111

CHEM 112 General Chemistry II (4 credits)

General Education: Natural/Integrated Science

Continuation of CHEM 111. Some work in inorganic chemistry, kinetics, equilibrium, liquids, solids, acid-base, electrochemistry, nuclear chemistry, thermodynamics, and qualitative inorganic analysis. Typically Offered: Fall and Spring.

Prereqs: CHEM 111 and CHEM 111L or Permission

CHEM 112L General Chemistry II Laboratory (1 credit)

General Education: Natural/Integrated Science

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 hour per week. Typically Offered: Fall and Spring.

Prereqs: CHEM 111L Prereqs or

Coreqs: CHEM 112

CHEM 200 (s) Seminar (1-16 credits)

Credit arranged

CHEM 204 (s) Special Topics (1-16 credits)

Credit arranged

CHEM 253 Quantitative Analysis (3 credits)

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

Prereqs: CHEM 112, CHEM 112L

CHEM 254 Quantitative Analysis: Lab (2 credits)

Laboratory portion of Quantitative Analysis (CHEM 253).

Prereqs or Coreqs: CHEM 253

CHEM 275 Carbon Compounds (3 credits)

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

Prereqs: CHEM 101 and CHEM 101L or CHEM 111 and CHEM 111L or Permission

CHEM 276 Carbon Compounds Lab (1 credit)

Lab to accompany CHEM 275; for students who need only 1 credit of lab. One 3-hour lab per week.

Prereqs or Coreqs: CHEM 275 or CHEM 277

CHEM 277 Organic Chemistry I (3 credits)

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

Prereqs: CHEM 112, CHEM 112L

CHEM 278 Organic Chemistry I: Lab (1 credit)

One 3-hour lab per week.

Prereqs or Coreqs: CHEM 277

CHEM 299 (s) Directed Study (1-16 credits)

Credit arranged

CHEM 302 Principles of Physical Chemistry (3 credits)

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

Prereqs: CHEM 112, CHEM 112L, MATH 160 or MATH 170 or MATH 175, and PHYS 111, PHYS 111L, or Permission

CHEM 303 Principles of Physical Chemistry Lab (1 credit)

Lab to accompany CHEM 302. One 3-hour lab per week. (Fall only)

Prereqs or Coreqs: CHEM 302

CHEM 305 Physical Chemistry (3 credits)

Kinetic theory, thermodynamics (work, heat and energy); state functions, thermochemistry, the second law of thermodynamics; free energy and mixtures; electrolyte solutions and phase equilibrium; chemical and electrochemical equilibrium. (Fall only)

Prereqs: CHEM 112 and CHEM 112L, and MATH 275

Coreqs: PHYS 212 or PHYS 213

CHEM 306 Physical Chemistry II (3 credits)

Kinetic theory, atomic and molecular structure, quantum mechanics, statistical mechanics. (Spring only)

Prereqs: CHEM 305

CHEM 307 Physical Chemistry Lab (1 credit)

Lab to accompany CHEM 305, CHEM 306. One 3-hour lab per week. (Fall only)

Prereqs or Coreqs: CHEM 305

CHEM 308 Physical Chemistry Lab (1 credit)

Lab to accompany CHEM 305, CHEM 306. One 3-hour lab per week. (Spring only)

Prereqs or Coreqs: CHEM 306

CHEM 372 Organic Chemistry II (3 credits)

Continuation of CHEM 277. (Spring only)

Prereqs: CHEM 277

CHEM 374 Organic Chemistry II: Lab (1 credit)

Lab to accompany CHEM 372; includes synthesis, structure determination, and mechanisms. One 3-hour lab per week. (Spring only)

Prereqs: CHEM 278

Prereqs or Coreqs: CHEM 372

CHEM 400 (s) Seminar (1-16 credits)

Credit arranged

CHEM 404 (s) Special Topics (1-16 credits)

Credit arranged

CHEM 409 Proseminar (1 credit)

General Education: Senior Experience

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.

Prereqs: CHEM 372 and junior standing

CHEM 418 Environmental Chemistry (3 credits)

Joint-listed with CHEM 518

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

Prereqs: CHEM 253, CHEM 254, and CHEM 275 or CHEM 277, or Permission

CHEM 436 Electronics for Scientists (2-4 credits, max 4)

Joint-listed with CHEM 535

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/years).

Prereqs: Permission

CHEM 454 Instrumental Analysis (3-4 credits)

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 lectures and one 4-hour lab per week. Permission required to register for 3 credits. (Spring only)

Prereqs: CHEM 253, CHEM 254, and CHEM 305

Prereqs or Coreqs: CHEM 306

CHEM 455 Survey of Analytical Chemistry (3 credits)

Fundamentals of modern analytical chemistry. Open only to chemistry M. S. and Ph. D. students. Credit is not allowed in both CHEM 454 and CHEM 455.

Prereqs: Permission

CHEM 463 Inorganic Chemistry (3 credits)

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)

Prereqs: CHEM 305 or Permission

CHEM 464 Inorganic Chemistry (3 credits)

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 required for graduate credit. (Spring only)

Prereqs or Coreqs: CHEM 463, or CHEM 466, or Permission

CHEM 465 Inorganic Chemistry Laboratory (1 credit)

Lab to accompany CHEM 464. One 3-hour lab per week. (Spring only)

Coreqs: CHEM 464

CHEM 466 Survey of Inorganic Chemistry (3 credits)

Fundamentals of modern inorganic chemistry. Open only to chemistry M. S. and Ph. D. students. Credit is not allowed in both CHEM 463 and CHEM 466.

Prereqs: CHEM 306 and Permission

CHEM 472 Medicinal Chemistry (3 credits)

Joint-listed with CHEM 572

A course at the interface of chemistry, biochemistry, and physiology, covering lipids/proteins/carbohydrates/nucleic acids as drug targets; discovery, design, optimization of pharmacodynamic and pharmacokinetic parameters, and development of drugs including overview of clinical trials; antibacterial/antiviral/anticancer agents and drugs acting on cholinergic and adrenergic nervous system; oligonucleotide-based therapeutics; emphasis on mechanism of drug action. Students give presentations on top-selling and/or highly prescribed drugs; graduate students write a report on a medicinal chemistry research article.

Prereqs: CHEM 277.

CHEM 473 Intermediate Organic Chemistry (3 credits)

Theories and mechanisms of organic chemistry. (Fall only)

Prereqs: CHEM 372

Prereqs or Coreqs: CHEM 306

CHEM 476 Survey of Organic Chemistry (3 credits)

Fundamentals of modern organic chemistry. Open only to chemistry M. S. and Ph. D. students. Credit is not allowed in both CHEM 473 and CHEM 476.

Prereqs: Permission

CHEM 491 (s) Research (1-6 credits, max 12)

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

Prereqs: Permission of department

CHEM 495 Statistical Thermodynamics (3 credits)

Cross-listed with PHYS 333

Classical thermodynamics, entropy, thermodynamic potentials, kinetic theory, classical and quantum statistical mechanics, ensembles, partition functions, introduction to phase transitions. Typically Offered: Spring (Even Years).

Prereqs: CHEM 306 or PHYS 305

CHEM 496 Survey of Physical Chemistry (3 credits)

Fundamentals of modern physical chemistry. Open only to chemistry M. S. and Ph. D. students. Credit is not allowed in both CHEM 495 and CHEM 496.

Prereqs: Permission

CHEM 498 (s) Internship (1-16 credits)

Credit arranged

CHEM 499 (s) Directed Study (1-16 credits)

Credit arranged

CHEM 500 Master's Research and Thesis (1-16 credits)

Credit arranged

CHEM 501 (s) Seminar (1 credit, max 2)**CHEM 502 (s) Directed Study (1-16 credits)**

Credit arranged

CHEM 503 (s) Workshop (1-16 credits)

Credit arranged

CHEM 504 (s) Special Topics (1-16 credits)

Credit arranged

CHEM 505 (s) Professional Development (1-16 credits)

Credit arranged

CHEM 506 Introduction to Teaching and Research Skills (2 credits)

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)

Prereqs: Permission**CHEM 511 Seminar (0 credits)****CHEM 518 Environmental Chemistry (3 credits)**

Joint-listed with CHEM 418

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

Prereqs: CHEM 253, CHEM 254, and CHEM 275 or CHEM 277, or Permission**CHEM 535 Electronics for Scientists (2-4 credits, 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/years).

Prereqs: Permission**CHEM 551 Electronic Spectrometry (2-3 credits, 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/years)

Prereqs: CHEM 454, CHEM 455 or Permission**CHEM 556 Molecular Spectroscopy (3 credits)**

Interpretation of IR, UV, NMR, and mass spectra. Registration for CHEM 556 requires completion of additional assignments.

Prereqs: CHEM 306 or Permission**CHEM 558 Electrochemistry (2-3 credits, 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/years)

Prereqs: CHEM 454, or CHEM 455, or Permission**CHEM 571 (s) Topics In Organic Chem (1-9 credits, max 9)**

Selected topics from the current literature.

Prereqs: CHEM 473, CHEM 476, or Permission**CHEM 572 Medicinal Chemistry (3 credits)**

Joint-listed with CHEM 472

A course at the interface of chemistry, biochemistry, and physiology, covering lipids/proteins/carbohydrates/nucleic acids as drug targets; discovery, design, optimization of pharmacodynamic and pharmacokinetic parameters, and development of drugs including overview of clinical trials; antibacterial/antiviral/anticancer agents and drugs acting on cholinergic and adrenergic nervous system; oligonucleotide-based therapeutics; emphasis on mechanism of drug action. Students give presentations on top-selling and/or highly prescribed drugs; graduate students write a report on a medicinal chemistry research article. Typically Offered: Unknown.

Prereqs: CHEM 277.**CHEM 590 Doctoral Research Proposal (1 credit)**

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 598 (s) Internship (1-16 credits)

Credit arranged

CHEM 599 (s) Non-thesis Master's Research (1-16 credits)

Credit arranged

CHEM 600 Doctoral Research and Dissertation (1-45 credits)

Credit arranged