

CHEMISTRY (CHEM)

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

- CHEM 1111–CHEM 1120–CHEM 2530
- CHEM 1101–CHEM 2750

CHEM 1101 Introduction to Chemistry (3 credits)

General Education: Scientific Ways of Knowing
Full credit may be earned in only one of the following: CHEM 1101 or CHEM 1111. General treatment of the fundamentals of chemistry. Does not satisfy the prerequisite for CHEM 1120. Typically Offered: Fall and Spring.

CHEM 1101L Introduction to Chemistry Laboratory (1 credit)

This is the companion laboratory course to CHEM 1101 and provides an introduction to Chemistry lab practices. It does not satisfy the lab requirement for CHEM 1111 or CHEM 1120. One 3-hour lab per week. Typically Offered: Fall and Spring. Prereqs or Coreqs: CHEM 1101

CHEM 1111 General Chemistry I (3 credits)

General Education: Scientific Ways of Knowing
Full credit may be earned in only one of the following: CHEM 1101, or CHEM 1111. Note that grades in CHEM 1111 will supersede any grades earned in CHEM 1101. 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 1101, MATH 1143, MATH 1160, or MATH 1170; or Permission

CHEM 1111L General Chemistry I Laboratory (1 credit)

This is the companion laboratory course to CHEM 1111 and provides an intensive treatment of chemistry lab practices. One 3-hour lab per week. Typically Offered: Fall and Spring. Prereqs or Coreqs: CHEM 1111

CHEM 1120 General Chemistry II (4 credits)

General Education: Scientific Ways of Knowing
Continuation of CHEM 1111. 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 1111 and CHEM 1111L or Permission

CHEM 1120L General Chemistry II Laboratory (1 credit)

This is the companion laboratory course to CHEM 1120 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 1111L Prereqs or Coreqs: CHEM 1120

CHEM 2000 (s) Seminar (1-16 credits, max 99)

Credit arranged

CHEM 2040 (s) Special Topics (1-16 credits, max 99)

Credit arranged

CHEM 2530 Quantitative Analysis (3 credits)

Fundamental principles and techniques of chemical analysis; intro to sampling, standardization, data evaluation, gravimetric/volumetric methods, and instrumental techniques. Typically Offered: Fall.
Prereqs: CHEM 1120, CHEM 1120L

CHEM 2540 Quantitative Analysis: Lab (2 credits)

Laboratory portion of Quantitative Analysis (CHEM 2530). Prereqs or Coreqs: CHEM 2530

CHEM 2750 Carbon Compounds (3 credits)

Aspects of organic chemistry important to students in the life sciences.
Prereqs: CHEM 1101 and CHEM 1101L or CHEM 1111 and CHEM 1111L or Permission

CHEM 2760 Carbon Compounds Lab (1 credit)

Lab to accompany CHEM 2750; for students who need only 1 credit of lab. One 3-hour lab per week. Prereqs or Coreqs: CHEM 2750 or CHEM 2770

CHEM 2770 Organic Chemistry I (3 credits)

Principles and theories of organic chemistry; properties, preparation, and reactions of organic compounds.
Prereqs: CHEM 1120, CHEM 1120L

CHEM 2780 Organic Chemistry I: Lab (1 credit)

One 3-hour lab per week. Prereqs or Coreqs: CHEM 2770

CHEM 2990 (s) Directed Study (1-16 credits, max 99)

Credit arranged

CHEM 3020 Principles of Physical Chemistry (3 credits)

Emphasis on topics important to biological and agricultural science. (Fall only)
Prereqs: CHEM 1120, CHEM 1120L, MATH 1160 or MATH 1170 or MATH 1750, and PHYS 1111, PHYS 1111L, or Permission

CHEM 3030 Principles of Physical Chemistry Lab (1 credit)

Lab to accompany CHEM 3020. One 3-hour lab per week. Typically Offered: Fall. Prereqs or Coreqs: CHEM 3020

CHEM 3050 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. Typically Offered: Fall.
Prereqs: CHEM 1120 and CHEM 1120L, and MATH 2750
Coreqs: PHYS 2120 or PHYS 2130

CHEM 3060 Physical Chemistry II (3 credits)

Kinetic theory, atomic and molecular structure, quantum mechanics, statistical mechanics. Typically Offered: Spring.
Prereqs: CHEM 3050

CHEM 3070 Physical Chemistry Lab (1 credit)

Lab to accompany CHEM 3050, CHEM 3060. One 3-hour lab per week. Typically Offered: Fall. Prereqs or Coreqs: CHEM 3050

CHEM 3080 Physical Chemistry Lab (1 credit)

Lab to accompany CHEM 3050, CHEM 3060. One 3-hour lab per week. Typically Offered: Spring. Prereqs or Coreqs: CHEM 3060

CHEM 3720 Organic Chemistry II (3 credits)

Continuation of CHEM 2770. Typically Offered: Spring.
Prereqs: CHEM 2770

CHEM 3740 Organic Chemistry II: Lab (1 credit)

Lab to accompany CHEM 3720; includes synthesis, structure determination, and mechanisms. One 3-hour lab per week. Typically Offered: Spring.
Prereqs: CHEM 2780 Prereqs or Coreqs: CHEM 3720

CHEM 4000 (s) Seminar (1-16 credits, max 99)

Credit arranged

CHEM 4040 (s) Special Topics (1-16 credits, max 99)

Credit arranged

CHEM 4090 Proseminar (1 credit)

General Education: Capstone 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 3720 and junior standing**CHEM 4180 Environmental Chemistry (3 credits)**

Joint-listed with CHEM 5180

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

Prereqs: CHEM 2530, CHEM 2540, and CHEM 2750 or CHEM 2770, or Permission**CHEM 4200 Forensic Chemistry (3 credits)**

Joint-listed with CHEM 5200

This course provides in-depth treatment of the chemical principles, analytical techniques, and instrumental requirements pertinent to forensic analysis. The focus is on DNA analysis, measurements involving body fluids, drug analysis (with emphasis on opioids and amphetamines), and soil and paint analysis. Typically Offered: Spring.

Prereqs: CHEM 2530 and CHEM 2770, or permission**CHEM 4360 Electronics for Scientists (2-4 credits, max 4)**

Joint-listed with CHEM 5350

Theory and application of analog and digital electronics used in scientific instrumentation. Registration for CHEM 5350 requires completion of an additional term paper or other assignment. Typically Offered: Fall and Varies.

Prereqs: Permission**CHEM 4540 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. Typically Offered: Spring.

Prereqs: CHEM 2530, CHEM 2540, and CHEM 3050 Prereqs or**Coreqs:** CHEM 3060**CHEM 4550 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 4540 and CHEM 4550.

Prereqs: Permission**CHEM 4630 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. Typically Offered: Fall.

Prereqs: CHEM 3050 or Permission**CHEM 4640 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. Typically Offered: Spring. Prereqs or

Coreqs: CHEM 4630, or CHEM 4660, or Permission**CHEM 4650 Inorganic Chemistry Laboratory (1 credit)**

Lab to accompany CHEM 4640. One 3-hour lab per week. Typically Offered: Spring.

Coreqs: CHEM 4640**CHEM 4660 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 4630 and CHEM 4660.

Prereqs: CHEM 3060 and Permission**CHEM 4720 Medicinal Chemistry (3 credits)**

Joint-listed with CHEM 5720

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 2770**CHEM 4730 Intermediate Organic Chemistry (3 credits)**

Theories and mechanisms of organic chemistry. Typically Offered: Fall.

Prereqs: CHEM 3720 Prereqs or**Coreqs:** CHEM 3060**CHEM 4760 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 4730 and CHEM 4760.

Prereqs: Permission**CHEM 4910 (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 4950 Statistical Thermodynamics (3 credits)**

Cross-listed with PHYS 3330

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 3060 or PHYS 3050**CHEM 4960 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 4950 and CHEM 4960.

Prereqs: Permission**CHEM 4980 (s) Internship (1-16 credits, max 99)**

Credit arranged

CHEM 4990 (s) Directed Study (1-16 credits, max 99)

Credit arranged

CHEM 5000 Master's Research and Thesis (1-16 credits, max 99)

Credit arranged

CHEM 5010 (s) Seminar (1 credit, max 2)**CHEM 5020 (s) Directed Study (1-16 credits, max 99)**

Credit arranged

CHEM 5030 (s) Workshop (1-16 credits, max 99)

Credit arranged

CHEM 5040 (s) Special Topics (1-16 credits, max 99)

Credit arranged

CHEM 5050 (s) Professional Development (1-16 credits, max 99)

Credit arranged

CHEM 5060 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 Pass/Fail. Typically Offered: Fall.

Prereqs: Permission**CHEM 5110 Seminar (0 credits, max 99)****CHEM 5180 Environmental Chemistry (3 credits)**

Joint-listed with CHEM 4180

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

CHEM 5200 Forensic Chemistry (3 credits)

Joint-listed with CHEM 4200

This course provides in-depth treatment of the chemical principles, analytical techniques, and instrumental requirements pertinent to forensic analysis. The focus is on DNA analysis, measurements involving body fluids, drug analysis (with emphasis on opioids and amphetamines), and soil and paint analysis. Typically Offered: Spring.

CHEM 5350 Electronics for Scientists (2-4 credits, max 4)

Joint-listed with CHEM 4360

Theory and application of analog and digital electronics used in scientific instrumentation. Registration for CHEM 5350 requires completion of an additional term paper or other assignment. Typically Offered: Fall and Varies.

CHEM 5510 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. Typically Offered: Varies.

Prereqs: CHEM 4540, CHEM 4550, or Permission**CHEM 5560 Molecular Spectroscopy (3 credits)**

Interpretation of IR, UV, NMR, and mass spectra. Registration for CHEM 5560 requires completion of additional assignments.

Prereqs: CHEM 3060 or Permission**CHEM 5580 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. Typically Offered: Varies.

Prereqs: CHEM 4540, or CHEM 4550, or Permission**CHEM 5710 (s) Topics In Organic Chem (1-9 credits, max 9)**

Selected topics from the current literature.

Prereqs: CHEM 4730, CHEM 4760, or Permission**CHEM 5720 Medicinal Chemistry (3 credits)**

Joint-listed with CHEM 4720

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.

CHEM 5900 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 5980 (s) Internship (1-16 credits, max 99)

Credit arranged

CHEM 5990 (s) Non-thesis Master's Research (1-16 credits, max 99)

Credit arranged

CHEM 6000 Doctoral Research and Dissertation (1-45 credits, max 99)

Credit arranged