DEPARTMENT OF CHEMISTRY

Ray von Wandruszka, Dept. Chair (116 Malcolm M. Renfrew Hall 83844-2343; phone 208/885-6552; chemoff@uidaho.edu). Faculty: Thomas E. Bitterwolf, Eric B. Brauns, I. Francis Cheng, W. Daniel Edwards, T. Rick Fletcher, Patrick J. Hrdlicka, Sharon J. Hutchison, Jacob Magolan, Sofie P. Pasilis, Jean'ne M. Shreeve, Daniel S. Stelck, Ray von Wandruszka, Chien M. Wai, Richard V. Williams.

Chemistry is the central science; the foundation on which a variety of applied and nonapplied disciplines build. Chemistry deals with the composition, structure, and properties of substances and the changes they undergo. It is the study of the materials of which the entire universe is composed. Chemistry graduates will find an impressive array of options and exciting opportunities in fields such as basic research, environmental protection, instrumentation, the search for and synthesis of new therapeutic drugs, new product and process development, technical marketing, market research, forensic chemistry, teaching at all levels, and information science. Moreover, an education in chemistry is valuable in health sciences such as medicine, pharmacology, clinical chemistry, and industrial hygiene. It can be useful as well in nontechnical areas such as advertising, journalism, patent law, banking, and investment counseling. The options are bounded only by the limits of one's imagination.

There are four distinct undergraduate curricula designed to meet a wide range of professional needs. The professional option is the curriculum of choice for students who are interested in practicing chemistry as a career, including graduate study for an advanced degree in chemistry or a related field. The degree is certifiable to the American Chemical Society. The general chemistry option provides a suitable foundation for those students needing a strong background in chemistry, but not necessarily aspiring to become professional chemists, such as those in Education or Chemical Engineering. The pre-medical option has been designed to serve the needs of those students interested in careers in medicine, pharmacy, dentistry, or other health related fields. The forensics option is a full-fledged chemistry degree that prepares students for a career in forensic science.

Students majoring in chemistry at UI have the very good fortune to interact with an award-winning, distinguished teaching faculty. They have a unique opportunity to participate in undergraduate research in a nurturing environment where they work side by side with graduate students, postdoctoral fellows, and faculty members. Very often the research carried out by undergraduates results in publications in leading chemical journals. As a result of the strong research programs in the department, undergraduates have the opportunity in their courses to have hands-on experience with, or to acquire data from, modern sophisticated instrumentation such as FT nuclear magnetic resonance spectrometers, gas chromatographs interfaced with mass spectrometers, and laser Raman, infrared and ultraviolet spectrometers, in addition to the more classical techniques. Considerable use of computers is made in laboratory courses and as an aid to instruction. Because our students receive a first-class education, they are in demand by prospective employers and graduate schools.

The Chemistry Department trains its B.S. graduates to attain a high level of familiarity with:

- basic chemical concepts and fundamental chemical processes;
- organic synthesis and characterization;
- analytical and environmental approaches and problem solving;
- inorganic, material, and nuclear chemical concepts and applications;
- physical chemical aspects of natural systems and theoretical modeling thereof.

In the course of their studies, students will acquire:

- strong lab techniques and synthetic skills;
- familiarity with the chemical literature and relevant search techniques;
- an awareness of safety issues;
- communication skills;
- problem solving skills;
- basic research skills;
- a sense of professionalism and competence.

M.S. and Ph.D. degrees are offered in chemistry with concentrations in analytical, inorganic, organic, and physical chemistry.

Entering graduate students (master's and doctoral candidates) are expected to demonstrate proficiency in chemistry by taking a series of four examinations in the areas of analytical (qualitative, quantitative, and instrumental), inorganic, organic (including qualitative organic analysis), and physical chemistry. These must be taken at the first offering after the student's arrival. These examinations are offered immediately before registration week of the fall and spring semesters. Questions are at an advanced undergraduate level.

Students who score at greater than the 50th percentile (established nationally) on a qualifying examination may begin with a 500-level course in that area in their first semester and are given credit for the relevant 400-level course (Chem 455, 466, 476, and/or 496). Students who score below the 50th percentile on an examination will begin course work in the respective area: analytical, Chem 454 (the lab in this course may be bypassed by petition if the student can present evidence of adequate exposure; previous course at B level); physical, Chem 495; inorganic, Chem 463; organic, Chem 473.

All candidates for the M.S. or Ph.D. degree in chemistry are required to have teaching experience, here or elsewhere, as part of their training and will complete Chem 506 (Introduction to Teaching and Research Skills) at their first opportunity on entering the program.

Chemistry graduate students will acquire advanced perspectives in analytical, inorganic, organic, and physical chemistry. They will gain a detailed understanding of the problems, challenges, and opportunities in their chosen subdiscipline, and an in-depth familiarity with the theoretical underpinnings and methodologies in their specific research area. Graduate students will also acquire skills in teaching, directing, and mentoring others.

Courses

See the course description section for courses in Chemistry (Chem).

Chemistry Undergraduate Curricular Requirements

Chemistry (B.S.)

Required course work includes the university requirements (see regulation J-3) and completion of one of the following options.

A. General Option

This degree provides the basic elements needed for a career in chemistry. It is especially suited for students who wish to enter other professions that require a background in science, including high school teaching, patent law, and technology management.

Chem 111	Principles of Chemistry I (4 cr)
Chem 112	Principles of Chemistry II (5 cr)
Chem 253, Chem 254	Quantitative Analysis and Lab (5 cr)
Chem 277, Chem 278	Organic Chemistry I and Lab (4 cr)
Chem 305, Chem 307	Physical Chemistry I and Lab (4 cr)
Chem 306, Chem 308	Physical Chemistry II and Lab (4 cr)
Chem 372, Chem 374	Organic Chemistry II and Lab (4 cr)
Chem 409	Proseminar (1 cr)
CS 101	Introduction to Computer Science or higher CS course (3 cr)
Math 170	Analytic Geometry and Calculus (4 cr)
Math 175	Analytic Geometry and Calculus II (4 cr)
Math 275	Analytic Geometry and Calculus III (3 cr)
Phys 211, Phys 211L	Engineering Physics I and Lab (4 cr)

One of the following (4 cr):

Phys 212, Phys	Engineering Physics II and Lab (4 cr)

212L	
Phys 213, Phys 213L	Engineering Physics III and Lab (4 cr)

Courses to total 120 credits for this degree

B. Professional Option

Note: Students who complete this option will be certifiable to the American Chemical Society.

This curriculum provides a suitable background for students wishing to enter the profession of chemistry or to pursue graduate study for an advanced degree in chemistry or a related field.

Biol 380	Biochemistry I (4 cr)
Chem 111	Principles of Chemistry I (4 cr)
Chem 112	Principles of Chemistry II (5 cr)
Chem 253, Chem 254	Quantitative Analysis and Lab (5 cr)
Chem 277, Chem 278	Organic Chemistry I and Lab (4 cr)
Chem 305, Chem 307	Physical Chemistry I and Lab (4 cr)
Chem 306, Chem 308	Physical Chemistry II and Lab (4 cr)
Chem 372, Chem 374	Organic Chemistry II and Lab (4 cr)
Chem 409	Proseminar (1 cr)
Chem 454	Instrumental Analysis (4 cr)
Chem 463	Inorganic Chemistry (3 cr)
Chem 464	Inorganic Chemistry (3 cr)
Chem 465	Inorganic Chemistry Laboratory (1 cr)
Chem 491	Research (2 cr)
CS 101	Introduction to Computer Science or higher CS course (3 cr)
Math 170	Analytic Geometry and Calculus (4 cr)
Math 175	Analytic Geometry and Calculus II (4 cr)
Math 275	Analytic Geometry and Calculus III (3 cr)
Phys 211, Phys 211L	Engineering Physics I and Lab (4 cr)

Two advanced chemistry courses approved by the Chemistry Department in accordance with American Chemical Society stipulations.

One of the following (4 cr):

Phys 212, Phys 212L	Engineering Physics II and Lab (4 cr)
Phys 213, Phys 213L	Engineering Physics III and Lab (4 cr)

Courses to total 120 credits for this degree

C. Pre-Medical Option

This curriculum provides a suitable foundation in chemistry for students who intend to enter careers in medicine, dentistry, pharmacy, etc.

Biol 115	Cells and the Evolution of Life (4 cr)
Biol 380, Biol 382	Biochemistry I and Lab (6 cr)
Chem 111	Principles of Chemistry I (4 cr)
Chem 112	Principles of Chemistry II (5 cr)
Chem 253, Chem 254	Quantitative Analysis and Lab (5 cr)
Chem 277, Chem 278	Organic Chemistry I and Lab (4 cr)
Chem 305, Chem 307	Physical Chemistry I and Lab (4 cr)
Chem 306, Chem 308	Physical Chemistry II and Lab (4 cr)
Chem 372, Chem 374	Organic Chemistry II and Lab (4 cr)
Chem 409	Proseminar (1 cr)
Chem 472	Medical Chemistry (3 cr)
CS 101	Introduction to Computer Science or higher CS course (3 cr)
Math 170	Analytic Geometry and Calculus (4 cr)
Math 175	Analytic Geometry and Calculus II (4 cr)
Math 275	Analytic Geometry and Calculus III (3 cr)
Phys 211, Phys 211L	Engineering Physics I and Lab (4 cr)
Phys 212, Phys 212L	Engineering Physics II and Lab (4 cr)

In addition, two courses must be selected from the following list:

Chem 454	Instrumental Analysis (4 cr)
Chem 473	Intermediate Organic Chemistry (3 cr)

Courses to total 120 credits for this degree

D. Forensics Option

Biol 115	Cells and the Evolution of Life (4 cr)
Biol 250, Biol 255	General Microbiology and Lab (5 cr)
Biol 380, Biol 382	Biochemistry I and Lab (6 cr)
Chem 111	Principles of Chemistry I (4 cr)
Chem 112	Principles of Chemistry II (5 cr)
Chem 253, Chem 254	Quantitative Analysis and Lab (5 cr)
Chem 277, Chem 278	Organic Chemistry I and Lab (4 cr)
Chem 305, Chem 307	Physical Chemistry and Lab (4 cr)
Chem 306, Chem 308	Physical Chemistry and Lab (4 cr)
Chem 372, Chem 374	Organic Chemistry II and Lab (4 cr)
Chem 409	Proseminar (1 cr)
Chem 454	Instrumental Analysis (4 cr)
Geol 426	Principles of Forensic Mineralogy and Geology (3 cr)
Math 170	Analytic Geometry and Calculus I (4 cr)
Math 175	Analytic Geometry and Calculus II (4 cr)
Math 275	Analytic Geometry and Calculus III (3 cr)
Phys 211, Phys 211L	Engineering Physics I and Lab (4 cr)
Stat 251	Statistical Methods (3 cr)

Any CS course (101 or higher) (3 cr)

One of the following (3-4 cr):

Biol 310, Biol 315	Genetics and Lab (4 cr)
Gene 314	General Genetics (3 cr)

One of the following (4 cr):

Phys 212, Phys 212L	Engineering Physics II and Lab **or**
Phys 213, Phys 213L	Engineering Physics III and Lab (4 cr)

Courses to total 120 credits for this degree

Chemistry Academic Minor Requirements

Chemistry Minor

This program is designed to give a non-chemistry major a sufficient background in general chemistry and laboratory techniques to improve his or her employment prospects as a laboratory technician and to improve the technical background of the student interested in science education or communication.

Chem 111	Principles of Chemistry I (4 cr)
Chem 112	Principles of Chemistry II (5 cr)
Chem 253, Chem 254	Quantitative Analysis and Lab (5 cr)
Chem 277, Chem 278	Organic Chemistry I and Lab (4 cr)
Chem 302, Chem 303	Principles of Physical Chemistry and Lab (4 cr)
Chem 372	Organic Chemistry II (3 cr)

Courses to total 20 credits for this minor

Chemistry Graduate Degree Programs

Candidates must fulfill the requirements of the College of Graduate Studies and of the Department of Chemistry. See the College of Graduate Studies section for the general requirements applicable to each degree.

Master of Science. (A) Thesis option: General M.S. requirements apply. At least one credit must be earned in Chem 501. (B) Non-thesis option: A minimum of 30 credits in course work is required and must be divided among the following: (1) 20 credits in chemistry courses numbered 500 or above (including one credit in Chem 501); (2) 10 credits in chemistry courses numbered 400 or above, or related courses numbered 300 or above. A written and/or oral examination that covers graduate course work must be taken during the final semester in residence.

Doctor of Philosophy – Major in Chemistry. The student will enroll for at least 33 credit hours in courses. All students will take Chem 509 (Advanced Physical Chemistry) and obtain two credits in Chem 501 (Seminar). In addition, sufficient credit hours of research will be completed to meet a total minimum registration requirement of 78 credits.

The student is encouraged to take courses in related fields, e.g., mathematics, physics, chemical engineering, geochemistry, computer science, electronics, or biochemistry. This work can be designated as the minor or supporting field on the study program.

All Ph.D. candidates are required to participate in seminar (Chem 501) while in residence, even though not formally registered for credit in this course. Registration may be for zero credit.

Cumulative examinations are general examinations in the student's field of specialization to judge the breadth of knowledge gained by the student from courses, lectures, and the literature, as well as the ability to use this knowledge in the solution of a variety of problems. Once started, a student must continue to take these examinations each time they are offered whenever the student is in residence and is eligible. If a given examination is not taken, a failing grade is received. Examinations are approximately three hours in length and are given four times each semester and, in exceptional cases, during the summer session. Normally, students will take examinations only in the chosen area of concentration, but they may elect to take them in other areas of chemistry. The student must obtain an average grade of 50% in eight examinations to continue in the Ph.D. program.

Shortly after completing the final cumulative examination, Ph.D. students are required to submit a written proposal on their doctoral research project and defend it at an oral examination by their graduate committee (Chem 590). The proposal will be limited to a maximum of 5,000 words, excluding the bibliography, and will consist of a statement of the proposed doctoral research problem, an in-depth discussion of the relevant literature, a listing of the major research objectives, a summary of the proposed experimental work plan, and an appropriate bibliography.

Doctor of Philosophy – Major in Biochemistry. A Ph.D. with major in biochemistry is offered by the Department of Biological Sciences. See that departmental section for information on the degree.

CHEMISTRY COURSES

Ray von Wandruszka, Dept. Chair, Dept. of Chemistry (116 Malcolm M. Renfrew Hall 83844-2343; phone 208/885-6552; chemoff@uidaho.edu).

Vertically-related courses in this subject field are: Chem 111-Chem 112-Chem 253; Chem 101-Chem 275.

Chem 050 Chemistry Fundamentals (0 cr)
Chemical problem solving, SI unit conversion, mole concept, chemical stoichiometry, solution concentration problems, periodic table, chemical formulas and nomenclature, and equation balancing. Graded P/N/F. A special fee is charged for this course.

Chem 101 Introduction to Chemistry I (4 cr)
Full credit may be earned in only one of the following: Chem 101, or Chem 111. General treatment of the fundamentals of chemistry. Three lec and one 3-hr lab a wk. Does not satisfy the prereq for Chem 112.

Chem 111 Principles of Chemistry I (4 cr)
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 lec and one 3-hr lab a week. Recommended Preparation: A grade of 'B' or better in a high school chemistry course.
Prereq: *Chem 050 or min 560 SAT math or min 25 ACT math or min 49 COMPASS College Algebra, or a grade of 'C' or better in Chem 101, Math 143, Math 160, or Math 170; or Permission*

Chem 112 Principles of Chemistry II (5 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 lec, one recitation, and one 3-hr lab a wk.
Prereq: *Chem 111 or Permission*

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. (Spring only)
Prereq: *Chem 112, and Math 275*
Prereq or Coreq: *Phys 212 or Phys 213*

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: *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: *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 Statistical Thermodynamics (3 cr)
See Phys 433.

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 Chem 496.
Prereq: *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 II (3 cr)
See Biol J454/J554.

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 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 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)

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