

## Steven Running, Director

Climate Change Studies is an inter-disciplinary program open to all majors. The program educates students in three areas of the climate change issue: science, society, and solutions. Coursework in the minor provides a foundation that enables students to engage the scientific, societal, and political dimensions of global climate change. Further, the focus on solutions with its orientation toward applied learning will help students develop critical thinking and problem solving skills. Participating students will enhance their major field of study. They will be better prepared to enter a broad range of professions and graduate programs where they can meet the emerging challenges and opportunities arising from climate change. Climate Change Studies is a joint program between the College of Forestry and Conservation, College of Arts and Sciences, and College of Technology.

## Requirements for a Minor

To earn a minor in Climate Change Studies, students must successfully complete 21.0 credits: a 3.0 credit interdisciplinary introductory course (CCS 203) and 6.0 credits in each of the three areas listed below.

Course # and Description	Credits
CCS 203 Climate Change: Science & Society	3
<b>Six credits from the following: Climate Change Science Courses</b>	<b>Credits</b>
CCS/GEO 108N Climate Change - Past and Future	3
CCS/ERTH 303N Weather and Climate	3
CCS/GEO 382 (UG) Global Change	3
CCS/FOR/BIO/GEO 408 Global Biogeochemical Cycles	3
CCS/GEO 448 (UG) Snow, Ice and Climate	3
<b>Six credits from the following: Climate Change Science Courses</b>	<b>Credits</b>
CCS/PSC 324 Sustainable Climate Policies: China and the USA	3
CCS/COMM/EVST 379 Communication, Consumption and Climate	3
CCS/RSCN 449 Climate Change Ethics and Policy	3
CCS/ECNS 445 International Environmental Economics and Climate Change	3
<b>Six credits from the following climate change solutions courses, with at least one course taken in category A, which requires practical application</b>	<b>Credits</b>
<b>Climate Change Solutions Courses: Category A</b>	
CCS/NRG 290 Energy Internship	2
CCS 398 Climate Change Internship	2-4
CCS 391 Climate Change Practicum	2-4
CCS/EVST 485 Environmental Citizenship	3
<b>Category B</b>	
CCS/NRG 102 Intro to Energy Systems II	3
CCS/BUS 160S Issues in Sustainability	3
CCS/NRG 191 Energy Practicum	2
CCS/CAR 235T Building Energy Conservation	3
CCS/NRG 242 Solar & Wind Systems	3

## Courses

**U CCS 102 Introduction to Energy Systems II, 3 cr.** Offered spring. Same as NRG 102. Prereq., NRG 101 or consent of instructor. A survey of renewable energy systems and technologies. Addresses physical and technical aspects of wind, solar, geothermal, hydro, tidal, biological, and wave energy systems. Consideration is given to engineering, economic, social, environmental, and political factors that determine implementation and sustainability.

**U CCS 108N Climate Change - Past and Future, 3 cr.** Offered autumn. Same as GEO 108N. The geoscience perspective on the earth's climate system. Climate processes and feedbacks, climate history from early earth to the ice ages, present and future changes due to natural processes and human activities.

**U CCS 160S Issues in Sustainability, 3 cr.** Offered autumn and spring. Same as BUS 160S. Literature-intensive course exposes the student to a variety of essays addressing the balance of economic development with the principles of sustainability and social equity. Introduction to sustainability concepts, natural systems/cycles and environmental economics.

**U CCS 191 Energy Practicum, 2 cr.** Offered summer. Same as NRG 191. Prereq., consent of instructor. practicum provides students with a supervised field experience. Students will gain hands-on experience with energy specific technologies. This opportunity increases students' occupational awareness and professionalism.

**U CCS 203 Climate Change: Science and Society, 3 cr.** Offered autumn. Foundational course on the scientific and social dimensions of global climate change with the goal of providing students with a basic understanding of the fundamental scientific, social, political and technological issues arising from rapid climatic change.

**U CCS 235 Building Energy Conservation, 3 cr.** Offered spring. Same as CAR 235. Study of the analysis techniques for reduction of energy consumption and energy management, including energy accounting and energy auditing. Residential and commercial building energy efficiency opportunities are covered. Other topics include motors, pumps, green building, purchasing energy supplies, and careers in energy efficiency.

**U CCS 242 Solar and Wind Systems, 3 cr.** Offered autumn. Same as NRG 242. Introduction to the fundamentals of solar and wind energy for the design and installation of solar and wind systems. Includes an overview of the physics and chemistry of the resource and the technology, and will prepare students for a career in renewable energy or for installing a renewable energy system on their own home.

**U CCS 298 Energy Internship, 2 cr.** Offered spring. Same as NRG 298. Prereq., consent of instructor. Students complete a field experience at an energy-related site or in an energy-related industry. A series of career development seminars and activities related to the field experience are completed in parallel.

**U CCS 303N Weather and Climate, 3cr.** Offered autumn. Same as EARTH 303N. Prereq., GEOG 102N or consent of instructor. Origin, composition, structure, and dynamics of the atmosphere, gas and radiation laws, energy budget and balance, weather elements and North American weather systems.

**U CCS 324 Sustainable Climate Policies: China and the USA, 3 cr.** Offered spring. Same as PSC 324. Not open to Fr So. Explores historic, current, and future greenhouse-gas (GHG) emissions of the United States and China, reasons why both are the two largest CO<sub>2</sub>emitters, and prevailing national and subnational government policies and nongovernmental actions that affect emissions mitigation and adaptation.

**UG CCS 382 Global Change, 3 cr.** Offered spring. Same as GEO 382. Prereq., consent of instructor. Lectures, readings, and discussions on geological and geochemical processes that affect global change using recent literature; carbon dioxide buildup, greenhouse effect, ozone depletion, desertification, ice ages, and other global events.

**U CCS 391 Climate Change Practicum 2-4 cr.** Offered autumn and spring. Prereq., consent of instructor. Provides an opportunity for students to design and implement a capstone project involving creative solutions to climate change.

**U CCS 379 Communication, Consumption, and Climate 3 cr.** Offered spring. Same as COMM 379 and EVST 379. Analyzes consumption as a communication practice, investigates discourses that promote consumption, and illuminates environmental impacts on consumption.

**U CCS 398 Climate Change Internship 2-4 cr.** Offered autumn and spring. Prereq., consent of instructor. Hands-on, "real world" experience working with local, regional, national, or international groups to address climate change. Students gain supervised, practical work experience with specific projects and organizations; create a network of professional contacts; and have an opportunity to apply ideas and approaches studied in the Climate Change Studies minor.

**UG CCS 408 Global Biogeochemical Cycles 3 cr.** Offered spring even numbered years. Same as FOR/BIOL/GEO 408. Exploration of how variations in the availability or utilization of critical Earth elements influences the atmosphere, the oceans, and the terrestrial biosphere including the natural and agricultural ecosystems on which we depend.

**UG CCS 445 International Environmental Economics and Climate Change, 3 cr.** Offered every other autumn. Same as ECON 445. Prereq., ECON 111. The economics of various policy approaches towards climate change and other international environmental issues such as trans-boundary pollution problems, international trade and the environmental, and the pollution haven hypothesis.

**UG CCS 449 Climate Change Ethics and Policy 3 cr.** Offered Fall. Same as EVST 449. This course focuses on the ethical dimensions of climate change policy. It covers the following major topics: (1) climate change, personal and collective responsibilities, (2) ethics, climate change and scientific uncertainty, (3) distributive justice and international climate change negotiations, (4) intergenerational justice and climate change policy.

**U CCS 485 Environmental Citizenship, 3 cr.** Offered spring. Same as EVST485. Open to juniors and seniors only or by permission of instructor. Develops environmental citizenship through student-initiated projects informed by principles of social marketing.

**UG CCS 488 Snow, Ice and Climate, 3 cr.** Offered spring. Same as GEO 488. Prereq., MATH 100. Study of basic physical processes occurring in snow and ice, and how these processes govern the interaction between frozen water and the climate system.

## Faculty

## Science Area

- Dr. Rebecca Bendick, Assistant Professor, Department of Geosciences

- Dr. Cory Cleveland, Assistant Professor of Soil Science
- Dr. Michael De Grandpre, Professor, Department of Chemistry
- Dr. Sarah Halvorson, Associate Professor and Departmental Chair of Geography
- Dr. Joel Harper, Associate Professor, Department of Geosciences
- Dr. Anna Klene, Associate Professor, Department of Geography
- Dr. Scott Mills, Professor of Wildlife Population Ecology
- Dr. Curtis Noonan, Associate Professor, Department of Biomedical and Pharmaceutical Sciences
- Dr. Steve Running, Regent's Professor of Ecology, Director of Numerical Terradynamics Simulation Group

### Society Area

- Dr. Richard Barrett, Emeritus Professor, Department of Economics, State Legislator
- Dr. Len Broberg, Professor, Department of Environmental Studies
- Dr. James Burchfield, Interim Dean and Research Professor, College of Forestry and Conservation
- Dr. Ulrich Kamp, Associate Professor, Department of Geography
- Dr. Derek Kellenberg, Assistant Professor, Department of Economics
- Dr. Peter Koehn, Professor, Department of Political Science
- Dr. Anna Prentiss, Associate Professor, Department of Anthropology
- Dr. Christopher Preston, Associate Professor, Department of Philosophy
- Dr. Rebecca Richards, Professor, Department of Sociology
- Dr. Steve Schwarze, Associate Professor, Department of Communication Studies
- Dr. Dane Scott, Director, Center of Ethics, Associate Professor, Department of Society and Conservation
- Dr. Terry Weidner, Director, Mansfield Center

### Solutions Area

- Dr. Georgia Cobbs, Associate Professor, Department of Curriculum and Instruction
- Dr. Brian Kerns, Engineer, Alternative Energy Technology Program
- Dr. Martin Horejsi, Assistant Professor, Department of Curriculum and Instruction
- Nicky Phear, Program Coordinator, Climate Change Studies and Wilderness and Civilization
- Dr. Ashley Preston, Program Director, Energy Technology Program
- Dr. Robin Saha, Assistant Professor, Department of Environmental Studies
- Lisa Swallow, Program Director, Department of Business Technology
- Nadia White, Assistant Professor, School of Journalism
- Dr. Laurie Yung, Director of Wilderness Institute; Research Assistant Professor

## Central and Southwest Asian Studies

### Ardi Kia, Advisor

The Central and Southwest Asian Studies Minor is available to all students. It consists of eighteen credits. Students selecting the minor are required to successfully complete HSTR 146 (HIST106)/ANTH/AS 106H and six credits in foundational Central and Southwest Asian Studies courses (200-level courses). Students must then complete nine credits of additional course work at the 300- or 400- level. No language courses are required; however, students pursuing the minor are strongly encouraged to meet the University-wide general education foreign language competency requirement by completing at least the second semester of one of the following languages (100 level or higher): Chinese, Persian, Arabic, Turkish or Russian. Participation in a study-abroad program is strongly recommended.

### Requirements for a Minor

To earn a minor in Central and Southwest Asian Studies, students must successfully complete 18 credits as follows:

1. ANTH 106H or AS 106H or HSTR 146H (HIST 106) The Silk Road 3 cr.
2. 6 cr. in approved 200-level foundational Central and Southwest Asian Studies courses: ANTH/HSTR 241 (HIST 214S)/AS 214, ANTH/HSTR262 (HIST 283H)/AS 283, ANTH/HSTR 264 (HIST 284H).
3. 9 cr. in approved 300 or 400-level Central and Southwest Asian Studies courses: ANTH 346 or HSTR 347 (HIST 386H)/AS 345, ANTH/HSTR 386 (HIST 386H), ANTH/HSTR 368 (HIST 387), ANTH 462/HSTR 442 (HIST 402)/AS 402, ANTH 461/HSTR 459 (HIST457)/AS 457, ANTH/AS 460/HSTR 441 (HIST 462).

In addition, it is expected that students will study one of the following languages: Turkish, Persian, Arabic, Russian or Chinese.

A list of approved Central and Southwest Asian courses is available from advisors.

## Department of Chemistry and Biochemistry

- [Special Degree Requirements](#)

- [Suggested Course of Study](#)
- [Courses](#)
- [Faculty](#)

## Mark S. Cracolice, Chair

Chemistry is the central science that involves the study of atoms and molecules, their structures, their combinations, their interactions, and the energy changes accompanying chemical processes.

The Department offers the following degrees: B.S., B.A., M.S., and Ph.D.

A departmental honors program has been established for chemistry majors who attain a strong scholastic record. This program is based upon independent study and research with the direction of individual faculty members. In many cases financial support is available on a part-time research fellowship basis from research grants obtained by individual faculty members or from departmental endowment funds.

Prospective students desiring further information on any program of the Department of Chemistry and Biochemistry should contact the Chair by visiting the [Department of Chemistry](#) and Biochemistry.

**High School Preparation:** In addition to the general University admission requirements, it is strongly recommended that a student take four years of mathematics, four years of science, and a foreign language.

Refer to graduation requirements listed previously in the catalog. See index.

## Special Degree Requirements

All chemistry and biochemistry majors must use the traditional letter grade option in registering for their required science and mathematics courses. The beginning mathematics course for a particular student depends upon a placement examination administered by the Department of Mathematical Sciences. Students are reminded of the University requirements that 39 of the 120 credits presented for graduation must be at the 300 or higher level, and that at least a 2.00 GPA must be earned in all credits attempted in the major. In addition, courses taken to satisfy the requirements of the major or minor must be completed with a grade of C- or better.

## Bachelor of Science (American Chemical Society Certified)

The courses required for the B.S. degree provide a solid education in chemistry for the professional chemist and in preparation for graduate work in most areas of chemistry. These requirements meet the latest certification standards of the American Chemical Society.

Course	Credits
CHMY 141N-143N (CHEM 161N-162N) College Chemistry I, II	10
CHMY 221-223 (CHEM 221-222) Organic Chemistry I, II	6
CHMY 222 (CHEM 223) Organic Chemistry I Laboratory	2
CHMY 225 (CHEM 264) Organic Chemistry Laboratory for Chemistry Majors (preferred) or 224 Organic Chemistry II Laboratory	2-3
CHMY 302E (CHEM 334) Chemistry Literature and Scientific Writing (satisfies the Upper-division Writing Expectation)	3
CHMY 311 (CHEM 341) Analytical Chem-Quant Analysis	4
CHMY 421 (CHEM 342) Advanced Instrumental Analysis	4
CHMY 373-371 (CHEM 371-372) Phys Chem-Kntcs & Thrmdynmcs & Phys Chem-Qntm Chm & Spctrscopy	8
CHMY 401-403 (CHEM 452-453) Advanced Inorganic Chemistry & Descriptive Inorganic Chem	6
BIOC 481 Biochemistry or equivalent	3
CHMY 402 (CHEM 455) Advanced Inorganic Chemistry Laboratory	2
Advanced Electives (from CHMY 391, 442, 445, 465, 491 and 3 credits maximum of 492, or 3 credit maximum of 499, or with consent of chemistry advisor, from advanced courses in chemistry, physics, geology, biochemistry, or mathematics (CHEM 395, 442, 445, 465, 495, 3 credits maximum of 497, or 3 credit maximum of 499, or with consent of chemistry advisor, from advanced courses in chemistry, physics, geology, biochemistry or mathematics)).	3
<b>Cognate courses:</b>	
CS 172 Computer Modeling (or similar computing experience with consent of chemistry advisor)	3
M 171-172 and 273 (MATH 152-153 and 251) Calculus I, II, III	12
M 311 (MATH 311) Ordinary Differential Equations and Systems or M 221 (MATH 221) Linear Algebra	3
PHYS 221N-222N General Physics I and II	10
Modern foreign language	10
WRIT 101 (ENEX 101)	3

At the time of graduation a recipient of this degree has the option of taking two semesters of one modern foreign language which, as a departmental requirement, may be taken credit/no credit. Students not taking this option will be required to take 2 additional advisor-

approved Chemistry & Biochemistry or related discipline electives for 3 credits each. This will bring the elective credits for this option to 9.

### **Bachelor of Science with a major in Chemistry, Option in Environmental Chemistry**

<b>Course</b>	<b>Credits</b>
CHMY 141N-143N (CHEM 161N-162N) College Chemistry I, II	10
CHMY 221-223 (CHEM 221-222) Organic Chemistry and Laboratory I, II	6
CHMY 222 (CHEM 223) Organic Chemistry Laboratory I	2
CHMY 225 (CHEM 264) Organic Chemistry Laboratory for Chemistry Majors or 224 Organic Chemistry II Laboratory	2-3
CHMY 302E (CHEM 334) Chemistry Literature and Scientific Writing (satisfies the Upper-division Writing Expectation)	3
CHMY 311 (CHEM 341) Analytical Chem-Quant Analysis	4
CHMY 421 (CHEM 342) Advanced Instrumental Analysis	4
CHMY 360 (CHEM 370) Applied Physical Chemistry or CHMY 373 (CHEM 371) Phys Chem-Kntcs & Thrmodynamics	3-4
CHMY 401 (CHEM 452) Advanced Inorganic Chemistry	3
BIOC 481 Biochemistry	3
BIOL 110N Principles of Biology or equivalent	4
BIOL 221 Cell and Molecular Biology	4
BIOL 223 Genetics and Evolution	4
GEO 101N-102N (GEOS 100N-101N) General Geology and Laboratory	3
GEO 327 (GEOS 327) Geochemistry	3
Electives from CHMY 373, 371, 442, 445, 403, 402, 465, 466; (CHEM 371, 372, 442, 445, 453, 455, 465, 466); 3 credits maximum of 792 (CHEM 497); BIOL 340, 453, 454, 455, 497, 3 credits maximum of 497; GEO 320, 382, 431, 420 (GEOS 320, 382, 431, 480), 3 credits maximum of 497; MICB 300, 416, 3 credits maximum of 497; STAT 452 (MATH 445); Modern Foreign Language (5 credits maximum)	8
M 162 (MATH 150) Applied Calculus or 171 (MATH 152) Calculus I	4
M 274 (MATH 158) Applied Differential Equations or 172 (MATH 153), Calculus II	3-4
STAT 451, 457 (MATH 444, 447) Statistics	4
PHYS 121N-122N or 221N-222N General Physics I, II	10

### **Bachelor of Science with a major in Chemistry, Option in Forensic Chemistry**

The Chemistry B.S. degree with the option in Forensic Chemistry forms a solid base for students interested in careers in forensic chemistry or advanced work in chemistry including graduate school.

At the time of graduation a recipient of this degree has the option of taking two semesters of one modern foreign language which, as a departmental requirement, may be taken credit/no credit. Students not taking this option will be required to take 2 additional advisor-approved Chemistry & Biochemistry or related discipline electives for 3 credits each. This will bring the elective credits for this option to 9.

<b>Course</b>	<b>Credits</b>
CHMY 141N-143N (CHEM 161N-162N) College Chemistry I, II	10
CHMY 221-223 (CHEM 221-222) Organic Chemistry I, II	6
CHMY 222 (CHEM 223) Organic Chemistry I Laboratory	2
CHMY 225 (CHEM 264) Organic Chemistry Laboratory for Chemistry Majors of CHMY 223 (CHEM 223) Organic Chemistry II Laboratory	2-3
CHMY 302E (CHEM 334) Chemistry Literature and Scientific Writing (satisfies the Upper-division Writing Expectation)	3
CHMY 311 (CHEM 341) Analytical Chem-Quant Analysis	4
CHMY 421 (CHEM 342) Advanced Instrument Analysis	4
CHMY 360 (CHEM 370) Applied Physical Chemistry or CHMY 373 (CHEM 371) Phys Chem-Kntcs & Thrmodynamics	3-4
BIOC 481-482 Biochemistry or equivalent	6
CHMY 401 (CHEM 452) Advanced Inorganic Chemistry	3

CHMY 488 (CHEM 488) Forensic Research or CHEM 498 Internship	3
CHMY 489 (CHEM 489) Forensic Science Seminar	1
ANTH 286N Survey of Forensic Science	3
BIOL 110N General Biology	4
BIOL 221 Cell and Molecular Biology	4
COMM 111A Public Speaking	3
M 171-172 (MATH 152-153) Calculus I, II	8
STAT 451 (MATH 444) Statistical Methods	3
STAT 457 (MATH 447) Computer Data Analysis	1
PHYS 221N-222N Fundamentals of Physics I & II	10
SOCI 211S (SOC 230S) Criminology	3
SOCI 221 (SOC 235) Criminal Justice	3
Electives from CHMY 465, 466, 542 (CHEM 465, 466, 542); ANTH 488; BIOL 223, 440; PHAR 110. (at least 8 of these credits must be in courses numbered 300 and above)	11

### **Bachelor of Science with a major in Chemistry, Option in Pharmacology**

<b>Course</b>	<b>Credits</b>
CHMY 141N-143N (CHEM 161N-162N) College Chemistry I, II	10
CHMY 221-223 (CHEM 221-222) Organic Chemistry and Laboratory I, II	6
CHMY 222 (CHEM 223) Organic Chemistry I Laboratory	2
CHMY 225 (CHEM 264) Organic Chemistry Laboratory for Chemistry Majors or 224 (CHEM 224) Organic Chemistry II Laboratory	2-3
CHMY 302E (CHEM 334) Chemistry Literature and Scientific Writing (satisfies the Upper-division Writing Expectation)	3
CHMY 311 (CHEM 341) Quantitative Analysis & Instrumental Methods	4
CHMY 421 (CHEM 342) Advanced Instrument Analysis	4
CHMY 360 (CHEM 370) Applied Physical Chemistry or CHMY 373 (CHEM 371) Phys Chem-Kntcs & ThrmDynamics	3-4
CHMY 401 (CHEM 452) Advanced Inorganic Chemistry	3
BIOC 481-482 Biochemistry	6
BIOL 110N Principles of Biology or equivalent	4
BIOL 221 Cell and Molecular Biology	4
MICB 302 Medical Microbiology	3
PHAR 341-342 Applied Anatomy and Physiology	8
PHAR 443-444 Pharmacology and Toxicology	8
Electives from CHMY 373, 371, 442, 445, 403, 402, 465, 466 (CHEM 371, 372, 442, 445, 453, 455, 465, 466), 3 credits maximum of 492 (CHEM 497); BIOL 3 credits maximum of 497; PHAR 421, 422, 3 credits maximum of 497	3
<b>Cognate courses:</b>	
M 162 (MATH 150) Applied Calculus or 171 (MATH 152) Calculus I	4
M 274 (MATH 158) Applied Differential Equations or 172 (MATH 153) Calculus II	3-4
PHYS 121N-122N or 221N-222N General Physics I, II	10

### **Bachelor of Arts Degree**

The courses required for the B.A. degree provide a less extensive training in chemistry than do the courses required for the American Chemical Society certified B.S. degree. This is to allow the student to supplement his or her program with courses that meet his or her specific needs. Thus this degree provides the core of traditional preparation in chemistry together with latitude for combination with an interdisciplinary field or the Teacher Preparation program. It is strongly advised that students using this degree obtain faculty advice in planning their program.

<b>Course</b>	<b>Credits</b>
CHMY 141N-143N (CHEM 161N-162N) College Chemistry I, II	10

CHMY 221-223 (CHEM 221-222) Organic Chemistry I, II	6
CHMY 222 (CHEM 223) Organic Chemistry I Laboratory	2
CHMY 225 (CHEM 264) Organic Chemistry Laboratory for Chemistry Majors or 224 (CHEM 224) Organic Chemistry II Laboratory	2-3
CHMY 302E (CHEM 334) Chemistry Literature and Scientific Writing (satisfies the Upper-division Writing Expectation)	3
CHMY 311 (CHEM 341) Analytical Chem-Quant Analysis	4
CHMY 421 (CHEM 342) Advanced Instrument Analysis	4
CHMY 373-371 (CHEM 371-372) Phys Chem-Kntcs & Thrmdynmcs & Phys Chem-Qntm Chm & Spctrscopy	8
* Advanced electives	15

#### Cognate courses:

CS 172 Introduction to Computer Modeling (or similar computing experience with approval of Chemistry advisor)	3
M 171, 172, 273 (MATH 152, 153, 251) Calculus I, II and III	12
PHYS 221N-222N (preferred) or 121N-122N General Physics I and II	10
Modern Foreign Language	10
WRIT 101 (ENEX 101) Composition.	3

\*As preparation for teaching at the secondary level, students should elect CHMY 401, 403, 485 (CHEM 452, 453, and 485), BIOC 380, STAT 216 (MATH 241), SCI 350 and teaching certification requirements including C&I 426 and SCI 350. A student should consult his or her chemistry advisor for other options.

At the time of graduation a recipient of this degree must have completed two semesters of one foreign language. The Department of Chemistry waives the foreign language requirement for a student who completes the B.A. degree in preparation for secondary teaching and who meets the requirements for teaching certification, including the student teaching requirement. These students still must meet the foreign language/symbolic systems competency requirement (likely via M 171 and 172 (MATH 152 and 153) for General Education as described in the Academic Policies and Procedures section of this catalog.

#### Teacher Preparation in Chemistry

**Major Teaching Field of Chemistry:** For an endorsement in the major teaching field of Chemistry, a student must complete the requirements for the above B.A. degree with a major in Chemistry with appropriate electives but without the foreign language requirement, and with the addition of CHMY 401, 403, and 485 (CHEM 452, 453, and 485). Students also must complete BIOC 380, STAT 216 (MATH 241), SCI 350, and C&I 426, gain admission to Teacher Education and Student Teaching and meet the requirements for certification as a secondary teacher (see the School of Education section of this catalog).

**Minor Teaching Field of Chemistry:** For an endorsement in the minor teaching field of Chemistry, a student must complete CHMY 101N, 141N-143N, 221-222-223, 312, 360 or 373 and 485 (CHEM 101N, 161N-162N, 221-222-223, 341, 370 or 371, and 485); BIOC 380, CS 101 or 172, M 162 (MATH 150) and STAT 216 (MATH 241), PHYS 121N-122N or PHYS 221N-222N, and SCI 350. Students also must complete C&I 426, gain admission to Teacher Education and Student Teaching and meet other requirements for certification as a secondary teacher (see the School of Education section of this catalog).

#### Suggested Course of Study

##### For B.S. Degree (American Chemical Society Certified)

First Year	A	S
CHMY 141N-143N (CHEM 161N-162N) College Chemistry I, II	5	5
CS 172 Computer Modeling	-	3
M 171-172 (MATH 152-153) Calculus I, II	4	4
WRIT 101 (ENEX 101) Composition	3	-
Electives and General Education	3	3
	15	15
Second Year	A	S
CHMY 221-223 (CHEM 221-222) Organic Chemistry I, II	3	3
CHMY 222 (CHEM 223) Organic Chemistry I Laboratory	2	-
CHMY 225 (CHEM 264) (or 224) Organic Chemistry Laboratory	-	3
M 273 (MATH 251) Calculus III	4	-
M 311 (MATH 311) Ordinary Differential Equations and Systems or M 221 (MATH 221) Linear Algebra	-	3
PHYS 221N-222N General Physics	5	5
Electives and General Education	-	3
	14	17
Third Year	A	S

CHMY 302E (CHEM 334) Chem Literature & Scientific Writing	3	-
CHMY 311 (CHEM 341) Analytical Chem-Quant Analysis	4	-
CHMY 421 (CHEM 342) Advanced Instrument Analysis	-	4
CHMY 373-371 (CHEM 371-372) Phys Chem-Kntcs & Thrmdynmes & Phys Chem-Qntm Chm & Spctrscopy	4	4
General Education (one upper-division)	6	9
	17	17

**Fourth Year**

	<b>A</b>	<b>S</b>
CHMY 401-403 (CHEM 452-453) Advanced Inorganic Chemistry	3	3
CHMY 402 (CHEM 455) Advanced Inorganic Chemistry Laboratory	-	2
BIOC 481 Biochemistry	3	-
Advanced CHEM elective	3	3
General Education	-	3
Upper-division elective	6	6
	15	17

**For B.S. Degree, Option in Environmental Chemistry**

**First Year**

	<b>A</b>	<b>S</b>
CHMY 141N-143N (CHEM 161N-162N) College Chemistry I, II	5	5
M 162 (MATH 150) Applied Calculus or 171 (MATH 152) Calculus I	4	-
M 274 (MATH 158) Applied Differential Equations or MATH 153 Calculus II	-	3-4
BIOL 110N Principles of Biology or equivalent.	-	4
WRIT 101 (ENEX 101) Composition	3	-
Electives and General Education	4	2
	16	14-15

**Second Year**

	<b>A</b>	<b>S</b>
CHMY 221-223 (CHEM 221-222) Organic Chemistry	3	3
CHMY 222 (CHEM 223) Organic Chemistry I Laboratory	2	-
CHMY 225 or 224 (CHEM 264 or 224) Organic Chemistry Laboratory	-	3
PHYS 121N-122N or 221N-222N General Physics I and II	5	5
BIOL 221 Cell and Molecular Biology	4	-
BIOL 223 Genetics and Evolution	-	4
GEO 101N-102N (GEOS 100N-101N) General Geology and Laboratory	3	-
	17	15

**Third Year**

	<b>A</b>	<b>S</b>
CHMY 302E (CHEM 334) Chem Literature & Scientific Writing	3	-
CHMY 311 (CHEM 341) Analytical Chem-Quant Analysis	4	-
CHMY 421 (CHEM 342) Advanced Instrument Analysis	-	4
CHMY 360 (CHEM 370) Applied Physical Chemistry or CHMY 373 (CHEM 371) Phys Chem-Kntcs & Thrmdynmes	-	3-4
GEO 327 (GEOS 327) Geochemistry	3	-
Electives and General Education	6	9
	16	16-17

**Fourth Year**

	<b>A</b>	<b>S</b>
BIOC 481-482 Biochemistry	3	-
CHMY 401 (CHEM 452) Advanced Inorganic Chemistry	3	-
CHMY 494 (CHEM 494) Seminar/Workshop	-	1
STAT 451/457 (MATH 444/447) Statistical Methods	4	-
Electives and General Education	4	15
	17	16

**For B.S. Degree, Option in Forensic Chemistry**

**First Year**

	<b>A</b>	<b>S</b>
CHMY 141N-143N (CHEM 161N-162N) College Chemistry I, II	5	5
M 171-172 (MATH 152-153) Calculus I, II	4	4
BIOL 110N Principles of Biology or equivalent	-	4
COMM 111A Public Speaking	3	-



WRIT 101 (ENEX 101) Composition	-	3
Electives and General Education	3	-
	15	16
<b>Second Year</b>		
	<b>A</b>	<b>S</b>
CHMY 221-223 (CHEM 221-222) Organic Chemistry	3	3
CHMY 223 (CHEM 223) and CHMY 225 or 224 (CHEM 264 or 224) Organic Chemistry I Laboratory	2	2
PHYS 221N-222N Fundamentals of Physics with Calculus I and II	5	5
BIOL 221 Cell and Molecular Biology	4	-
SOCI 211S (SOC 230S) Criminology	3	-
ANTH 286N Survey of Forensic Science	-	3
General Education	-	3
	17	16
<b>Third Year</b>		
	<b>A</b>	<b>S</b>
CHMY 302E (CHEM 334) Chem Literature & Scientific Writing	3	-
CHMY 311 (CHEM 341) Analytical Chem-Quant Analysis	4	-
CHMY 421 (CHEM 342) Advanced Instrument Analysis	-	4
CHMY 360 (CHEM 370) Applied Physical Chemistry	-	3
STAT 451/457 (MATH 444/447) Statistical Methods	4	-
SOCI 221 (SOC 235) Criminal Justice	-	3
Electives and General Education	6	6
	15	16
<b>Fourth Year</b>		
	<b>A</b>	<b>S</b>
BIOC 481-482 Biochemistry	3	3
CHMY 401 (CHEM 452) Advanced Inorganic Chemistry	3	-
CHMY 488 (CHEM 488) Forensic Research	-	3
CHMY 489 (CHEM 489) Forensics Research Seminar	1	-
Electives and General Education	9	9
	16	15

### For B.S. Degree, Option in Pharmacology

<b>First Year</b>		
	<b>A</b>	<b>S</b>
CHMY 141N-143N (CHEM 161N-162N) College Chemistry I, II	5	5
M 162 (MATH 150) Applied Calculus or 171 (MATH 152) Calculus I	4	-
M 274 (MATH 158) Applied Differential Equations or M 172 (MATH 153) Calculus II	-	3-4
BIOL 110N Principles of Biology or equivalent	-	4
WRIT 101 (ENEX 101) Composition	3	-
Electives and General Education	4	2
	16	14-15
<b>Second Year</b>		
	<b>A</b>	<b>S</b>
CHMY 221-223 (CHEM 221-222) Organic Chemistry	3	3
CHMY 222 (CHEM 223) Organic Chemistry I Laboratory	2	-
CHMY 225 or 224 (CHEM 264 or 224) Organic Chemistry Laboratory	-	3
PHYS 121N-122N or 221N-222N General Physics I and II	5	5
BIOL 221 Cell and Molecular Biology	4	-
Electives and General Education	-	6
	17	15
<b>Third Year</b>		
	<b>A</b>	<b>S</b>
CHMY 302E (CHEM 334) Chem Literature & Scientific Writing	3	-
CHMY 311 (CHEM 341) Analytical Chem-Quant Analysis	4	-
CHMY 421 (CHEM 342) Advanced Instrument Analysis	-	4
CHMY 360 (CHEM 370) Applied Physical Chemistry or CHMY 373 (CHEM 371) Phys Chem-Kntcs & Thrmodynamics	-	3-4
MICB 302E Medical Microbiology	3	-
PHAR 341-342 Applied Anatomy and Physiology	4	4
Electives and General Education	3	6
	17	17-18

<b>Fourth Year</b>		<b>A</b>	<b>S</b>
BIOC 481-482 Biochemistry		3	3
CHMY 401 (CHEM 452) Advanced Inorganic Chemistry		3	-
PHAR 443-444 Pharmacology and Toxicology		4	4
Electives and General Education		6	7
		16	14

### For B.A. Degree

<b>First Year</b>		<b>A</b>	<b>S</b>
CHMY 141N-143N (CHEM 161N-162N) College Chemistry I, II		5	5
CS 172 Introduction to Computer Modeling		-	3
WRIT 101 (ENEX 101) Composition		3	-
M 171-172 (MATH 152-153) Calculus I and II		4	4
General Education or electives		3	3
		15	15

<b>Second Year</b>		<b>A</b>	<b>S</b>
CHMY 221-223 (CHEM 221-222) Organic Chemistry		3	3
CHMY 222 (CHEM 223) Organic Chemistry I Laboratory		2	-
CHMY 225 (CHEM 264) (or 224) Organic Chemistry Laboratory		-	3
M 273 (MATH 251) Calculus III		4	-
PHYS 221N-222N General Physics		5	5
General Education or electives		-	6
		14	17

<b>Third Year</b>		<b>A</b>	<b>S</b>
CHMY 302E (CHEM 334) Chem Literature & Scientific Writing		3	-
CHMY 311 (CHEM 341) Analytical Chem-Quant Analysis		4	-
CHMY 421 (CHEM 342) Advanced Instrument Analysis		-	4
CHMY 373-371 (CHEM 371-372) Phys Chem-Kntcs & Thrmdynmcs & Phys Chem-Qntm Chm & Spctrscopy		4	4
Advanced electives		3	3
General Education		3	6
		17	17

<b>Fourth Year</b>		<b>A</b>	<b>S</b>
Advanced CHEM elective		3	3
General Education or elective		3	-
Modern Foreign Language		5	5
Upper-division elective		6	6
		17	14

**Requirements for a Minor** To earn a minor in chemistry the student must complete CHMY 141N, 143N, 221, 222, 223, 311, 360 or 373 (CHEM 161N, 162N, 221, 222, 223, 341, 370 or 371) and at least two courses from one of the following groups:

(a) CHMY 422, 371, 442, 445, 401, 403, 465 (CHEM 342, 372, 442, 445, 452, 453, 465)

(b) If the student's major does not require biochemistry, BIOC 380 or 481 and 482

For teaching minor requirements, see the Teacher Preparation in Chemistry section above.

### Courses

U = for undergraduate credit only, UG = for undergraduate or graduate credit, G = for graduate credit. R after the credit indicates the course may be repeated for credit to the maximum indicated after the R. Credits beyond this maximum do not count toward a degree.

#### Chemistry (CHMY)

**U 101N (CHEM 101N) Chemistry for the Consumer 3 cr.** Offered spring. An introduction to chemistry that emphasizes the influence of chemistry on one's everyday life. Common household products, such as soap, aspirin, toothpaste, face cream and fertilizers are prepared in the lab.

**U 104 (CHEM 104) Preparation for Chemistry 3 cr.** Offered autumn. An introduction to chemistry for those who believe they have an

inadequate background to enroll in CHMY 121N or 141N (CHEM 151N or 161N). Not appropriate toward chemistry requirement in any major.

**U 121N (CHEM 151N) Intro to General Chemistry 3 cr.** Offered autumn and spring. First semester of an introduction to general, inorganic, organic and biological chemistry.

**U 122 (CHEM 153) Intro to General Chemistry Laboratory 1 cr.** Offered autumn and spring. Prereq., Enrolled in the College of Technology ASRN program. Prereq. or coreq., CHMY 121N (CHEM 151N) or equivalent. A laboratory course emphasizing inorganic chemistry, quantitative relations and synthesis of inorganic and organic compounds.

**U 123N (CHEM 152N) Intro Organic and Biological Chemistry 3 cr.** Offered autumn and spring. Prereq., "C-" or equiv. in CHMY 121N (CHEM 151N) or consent of instr. Second semester of an introduction to general, inorganic, organic and biological chemistry.

**U 124N (CHEM 154N) Intro Organic and Biological Chemistry Laboratory 2 cr.** Offered autumn and spring. Prereq. or coreq., CHMY 123N (CHEM 152N). Laboratory to accompany CHMY 123N (CHEM 152N).

**U 141N (CHEM 161N) College Chemistry I 5 cr.** Offered autumn and spring. Prereq., high school algebra. For science majors and other students intending to take more than one year of chemistry. Properties of elements, inorganic compounds, liquid solutions, chemical equilibria and chemical kinetics. Includes laboratory.

**U 143N (CHEM 162N) College Chemistry II 5 cr.** Offered spring and summer. Prereq., "C-" or better in CHMY 141N (CHEM 161N) or consent of instr. A continuation of CHMY 141N. Includes Laboratory.

**U 191 (CHEM 195) Special Topics Variable cr.** (R-6) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

**U 221 (CHEM 221) Organic Chemistry I 3 cr.** Offered autumn. Prereq., CHMY 123N or 143N (CHEM 152N or 162N). The chemical and physical properties of organic compounds.

**U 222 (CHEM 222) Organic Chemistry I Laboratory 2 cr.** Offered autumn. Coreq., CHMY 221 (CHEM 221); prereq., one semester of 100-level laboratory. Microscale techniques are emphasized.

**U 223 (CHEM 223) Organic Chemistry II 3 cr.** Offered spring. Prereq., CHMY 221 (CHEM 221). Continuation of 221.

**U 224 (CHEM 224) Organic Chemistry II Laboratory 2 cr.** Offered spring. Prereq., CHMY 223 (CHEM 223); prereq. or coreq., CHMY 222 (CHEM 222).

**U 225 (CHEM 264) Organic Chemistry Laboratory for Chemistry Majors 3 cr.** Offered spring. Prereq., CHMY 223 (CHEM 223); coreq., CHMY 222 (CHEM 222). Second semester of organic chemistry laboratory for chemistry majors only. Incorporates larger-scale techniques and instrumental organic analysis.

**U 291 (CHEM 295) Special Topics 1-6 cr.** (R-6) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

**U 292 (CHEM 297) Independent Study cr.** (R-10) Offered autumn and spring. Prereq., one semester of chemistry and consent of instr. Laboratory investigations and research in the laboratory of a faculty member.

**U 302E (CHEM 334) Chemistry Literature and Scientific Writing 3 cr.** Offered autumn. Prereq., CHMY 223 (CHEM 222) and chemistry major. Presentation and discussion of current literature in chemistry. Use of library and search tools. Workshop for developing and improving skills in scientific writing and evaluation. Use of on-line data bases and the interface of these with PC-based word processing and scientific graphics programs.

**U 311 (CHEM 341) Analytical Chem-Quant Analysis 4 cr.** Offered autumn. Prereq., one year of college chemistry, including laboratory. Classroom and laboratory work in gravimetric, volumetric, colorimetric and electrochemical methods of analysis; theory of errors; ionic equilibria in aqueous solutions.

**UG 360 (CHEM 370) Applied Physical Chemistry 3 cr.** Offered spring. Prereq., CHMY 123 OR 143 AND M 162 (CHEM 152 or 162 and MATH 150). Basic thermodynamics and chemical kinetics with applications in the biological and environmental sciences. Credit not allowed for both 360 and 373 (CHEM 370 and 371).

**UG 371 (CHEM 372) Physical Chemistry Qntm Chm & Spctrscpy 4 cr.** Offered spring. Prereq., CHMY 373 (CHEM 371). Systematic treatment of the laws and theories relating to chemical phenomena.

**UG 373 (CHEM 371) Physical Chemistry Kntcs & Thrmdynmcs 4 cr.** Offered autumn. Prereq., CHMY 143 (CHEM 162), M 273 (MATH 251), PHYS 122 or 222. Systematic treatment of the laws and theories relating to chemical phenomena. Credit not allowed for both CHMY 360 and 373 (CHEM 370 and 371).

**U 391 (CHEM 395) Special Topics Variable cr.** (R-9) Offered intermittently. Experimental offerings of visiting professors, experimental

offerings of new courses, or one-time offerings of current topics.

**U 397 (CHEM 380) Teaching Chemistry 1 cr.** Offered every term. Prereq., CHMY 141N-143N (CHEM 161N-162N) with B or better and consent of instr. Methods of peer-led team learning as applied to general chemistry instruction. Review of concepts from general chemistry. Student leaders mentor a team of general chemistry students in working toward constructing chemistry knowledge and developing problem-solving skills.

**U 398 (CHEM 398) Internship Variable cr.** Offered autumn and spring. Prereq., consent of department. Extended classroom experience which provides practical application of classroom learning during placements off campus. Prior approval must be obtained from the faculty supervisor and the Internship Services office. A maximum of 6 credits of Internship (198, 298, 398, 498) may count toward graduation.

**UG 401 (CHEM 452) Advanced Inorganic Chemistry 3 cr.** Offered autumn. Prereq., CHMY 223 AND 360 OR 373 (CHEM 222 and 370 or 371) or consent of instr. Theory and principles of inorganic chemistry and a systematic coverage of descriptive inorganic chemistry in the context of the periodic table.

**UG 402 (CHEM 455) Advanced Inorganic Chemistry Laboratory 2 cr.** Offered spring. Prereq., CHMY 224 AND 360 or 373 (CHEM 224 and 370 or 371) and consent of instr. Preparation of inorganic and coordination compounds. Isolation and characterization by ion exchange, column chromatography, IR, UV-VIS, derivatives, MP, and BP.

**U 403 (CHEM 453) Descriptive Inorganic Chemistry 3 cr.** Offered spring. Prereq., CHMY 221-222, 360 or 373-371, and 401 (CHEM 221-223, 370 or 371-372 and 452). A survey of the chemistry of the elements including transition metal reaction mechanisms, redox chemistry, organometallic chemistry, bioinorganic chemistry.

**UG 421 (CHEM 342) Advanced Instrumental Analysis 4 cr.** Offered spring. Prereq., CHMY 311 (CHEM 341). Theory and use of instrumental methods in the study of analytical and physical chemistry.

**UG 442 (CHEM 442) Aquatic Chemistry 3 cr.** Offered autumn odd-numbered years. Prereq., CHMY 311 (CHEM 341) or consent of instr. Application of chemical equilibria theory for understanding and modeling chemical processes in natural waters with an emphasis on spreadsheet computations. In depth examination of concepts such as pH, alkalinity, buffering, and solubility as they apply to natural waters.

**UG 445 (CHEM 445) Industrial Chemistry and Its Impact on Society 3 cr.** Offered every other autumn semester. Prereq., CHMY 143 or 123 (CHEM 162 or 152). A course based on local Montana chemical industries involving field trips to chemical plants, visits by company personnel and an overall evaluation of the company's economic and environmental impact on the community.

**UG 465 (CHEM 465) Organic Spectroscopy 3 cr.** Offered intermittently. Prereq., CHMY 360 or 373 (CHEM 370 or 371) and one year of organic chemistry or consent of instr. Theory and interpretation of the NMR, IR, UV, and mass spectra of organic compounds with the goal of structure identification.

**U 466 (CHEM 466) FT-NMR Operation for Undergraduate Research 1 cr.** Offered intermittently. Prereq., CHMY 221-222 (CHEM 221-223); research project using NMR; consent of instr. Operation of the FT-NMR spectrometer and brief background of NMR spectroscopy.

**U 480 (CHEM 441) Techniques of Glass Manipulation 1 cr.** Offered intermittently. Fabrication and repair of laboratory glassware. Basic operations include cutting glass, bending, end seals, joining (same and different diameters), T-seals, bulbs, ring or inner seals, condensers.

**UG 485 (CHEM 485) Laboratory Safety 1 cr.** Offered autumn. Prereq., one year of college chemistry. Awareness of and methods of control of hazards encountered in laboratory work. Awareness of legal constraints on work with chemicals. Sources of information regarding chemical hazards.

**U 488 (CHEM 488) Forensic Research 3 cr.** Offered autumn, spring and summer. Prereq., consent of instr. Laboratory investigations and research on forensic chemistry topics under the direction of a faculty member.

**U 489 (CHEM 489) Forensic Research Seminar 1 cr.** Offered autumn. Prereq., CHMY 421 (CHEM 342) and ANTH 286N. Seminar speakers on forensic science topics in the areas of ethics, law, anthropology and criminology; tours of the Montana State Crime Laboratory.

**U 490 (CHEM 497) Undergraduate Research 1-9 cr.** Undergraduate Research Variable cr (R-9). Offered autumn, spring, and summer. Prereq., consent of instr. Laboratory investigations and research in the laboratory of a faculty member.

**UG 491 (CHEM 495) Special Topics Variable cr.** (R-9) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses or one-time offerings of current topics.

**UG 492 Independent Study cr.** (R-9) Offered autumn and spring. Prereq., consent of instr. Laboratory investigations and research in the laboratory of a faculty member.

**UG 494 (CHEM 494/497) 1-9 cr.** (R-9) Offered autumn and spring. Prereq., consent of instr. Laboratory investigations and research in the laboratory of a faculty member.

**U 498 (CHEM 498) Internship 1-6 cr.** Prereq., consent of department. Extended non-classroom experience which provides practical

application of classroom learning during placements off campus. Prior approval must be obtained from the faculty supervisor and the Internship Services office. A maximum of 6 credits of Internship (198, 298, 398, 498) may count toward graduation.

**U 499 (CHEM 499) Senior Thesis 3 cr.** Offered autumn and spring. Prereq., CHMY 490 or consent of instr. and senior standing. Students complete and report on undergraduate research initiated as CHEM 490 or equivalent research experience. Reports are both oral and written.

**G 501 (CHEM 501) Teaching University Chemistry 1 cr.** Offered autumn. Preparation for teaching chemistry at the college level. A survey of teaching fundamentals and educational psychology as applied to chemistry instruction.

**G 541 (CHEM 541) Environmental Chemistry 3 cr.** Offered intermittently. Prereq., CHMY 360 OR 373 (CHEM 370 or 371). Chemical principles and reactions in natural systems: Fate of chemical contaminants in the environment; partitioning of contaminants between phases (air/water/soil); chemistry of atmospheric pollutants; computer modeling of equilibrium and kinetic processes; degradation and transformation of organic contaminants.

**G 542 (CHEM 542) Separation Science 3 cr.** Offered autumn odd-numbered years. Prereq., CHMY 421 (CHEM 342), CHMY 360 (CHEM 370) or 373 (CHEM 371). Theory, method development, and application of analytical separations; solvent extraction; solid phase extraction; various forms of chromatography; electrophoresis.

**G 544 (CHEM 544) Applied Spectroscopy 3 cr.** Offered intermittently. Prereq., CHMY 421 (CHEM 342) or consent of instr. The function and application of optical (ultraviolet to infrared) chemical instrumentation. Specific topics include optics, light sources, detectors and a wide variety of spectrochemical methods with an emphasis on methods not typically covered in undergraduate instrumental analysis courses.

**G 553 (CHEM 553) Inorganic Chemistry and Current Literature 4 cr.** Offered spring. Prereq., CHMY 401 (CHEM 452). A survey of the elements including transition metal reaction mechanisms, redox chemistry, organometallic chemistry, bioinorganic chemistry. Oral and written presentations on primary literature.

**G 561 (CHEM 561) Bioorganic Chemistry of Antibiotic and Natural Product Biosynthesis 3 cr.** Offered intermittently. Prereq., one year of organic chemistry; preferred prereq. or coreq., biochemistry. Comprehensive study of the bioorganic chemistry of antibiotic and natural product production in bacteria, plants, and higher animals, focusing on polyketide, shikimate, alkaloid, terpene, and nitrogen-containing/non-alkaloid compounds. Natural product diversity, drug screening and dereplication, combinatorial biochemistry, and pathway manipulation to produce "non-natural" natural products.

**G 562 (CHEM 562) Organic Structure and Mechanism 3 cr.** Offered intermittently. Prereq., one year of organic chemistry. Topics may include: stereochemistry, conformational analysis, aromaticity, transition state theory, isotope effects, solvent effects, substitution and elimination reactions, and mechanisms that involve carbocations, carbanions, radicals and carbenes as reactive intermediates.

**G 563 (CHEM 563) Organic Synthesis 3 cr.** Offered intermittently. Prereq., CHMY 221-223 (CHEM 221, 222). Theoretical treatise of the common methods used in organic synthesis including: oxidation, reduction, organometallics, C-C bond forming reactions, synthetic strategies and total synthesis.

**G 564 (CHEM 564) Organic Reactions 3 cr.** Offered intermittently. Prereq., one year of organic chemistry. Reactions such as alkylation of nucleophilic carbons, reactions of carbon nucleophiles with carbonyl groups, functional group interconversions by nucleophilic substitution reactions, electrophilic additions to carbon-carbon multiple bonds, and select oxidations/reductions.

**G 566 (CHEM 566) FT-NMR Operation for Graduate Researchers 1 cr.** Offered intermittently. Prereq., CHMY 221-222 (CHEM 221-223); research project using NMR; consent of instr. Operation of the FT-NMR spectrometer and brief background of NMR spectroscopy.

**G 568 (CHEM 568) Organometallic Chemistry 3 cr.** Offered intermittently in autumn. Prereq., CHMY 221, 223, 401, 403 (CHEM 221, 222, 452, 453). Survey of the reactivity and structure of main group and transition metal organometallic compounds with an emphasis on applications to organic synthesis and catalysis.

**G 569 (CHEM 569) Medicinal Chemistry 3 cr.** Offered intermittently. Prereq., CHMY 221, 223 (CHEM 221, 222); BIOC 380 or equiv. Same as BMED 621. Introduction to the historical and contemporary discoveries in medicinal chemistry.

**G 573 (CHEM 573) Advanced Physical Chemistry 3 cr.** Offered autumn. Prereq., CHMY 371-373 (CHEM 371-372). Fundamental principles of physical chemistry and special applications.

**G 580 (CHEM 580) Advanced Graduate Student Research Seminars 1 cr.** (R-10) Offered every term. Prereq., consent of instr. Formal oral and written presentations of research results and selected literature topics in a designated area.

**G 581 (CHEM 581) Chemical Biology 3 cr.** Offered intermittently. Prereq., consent of instr. Synthesis and structure of native and modified biomolecules such as antisense phosphothioate oligonucleotides, modified nucleosides and nucleotides designed for antiviral activity, and PNAs (protein nucleic acids). Emphasis on the interaction of biomolecules and a "small" organic and inorganic molecules and their chemical impact on native structure and function.

**G 593 (CHEM 593) Professional Project 3 cr.** Offered autumn and spring. Prereq., consent of instr.

**G 595 (CHEM 595) Special Topics Variable cr.** (R-9) Offered intermittently. Prereq., consent of instr. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

**G 596 (CHEM 596) Independent Study Variable cr.** (R-9) Offered autumn and spring. Prereq., consent of instr.

**G 597 (CHEM 597) Research Variable cr.** (R-open) Offered autumn and spring. Prereq., consent of instr.

**G 598 (CHEM 598) Cooperative Education Experience Variable cr.** (R-8) Offered autumn and spring. Prereq., consent of department. Extended non-classroom experience which provides practical application of classroom learning during placements off campus. Prior approval must be obtained from the faculty supervisor and the Internship Services office.

**G 599 (CHEM 599) Thesis Variable cr.** (R-6) Offered autumn and spring. Prereq., consent of instr.

**G 630 (CHEM 630) Seminar 1 cr.** (R-open) Offered autumn and spring. Prereq., graduate standing in chemistry or biochemistry, or consent of instr.

**G 640 (CHEM 640) Introductory Graduate Seminar 1 cr.** (R-open) Offered autumn. Prereq., graduate standing in chemistry or biochemistry or consent of instr. Seminar to acquaint new graduate students with departmental research.

**G 650 (CHEM 650) Graduate Chemistry Seminar 1 cr.** (R-open) Offered spring. Prereq., graduate standing.

**G 697 (CHEM 697) Research Variable cr.** (R-open) Offered autumn and spring. Prereq., consent of instr.

**G 699 (CHEM 699) Dissertation Variable cr.** (R-10) Offered autumn and spring.

## **Faculty**

### **Professors**

Bruce E. Bowler, Ph.D., Massachusetts Institute of Technology, 1986

Mark S. Cracolice, Ph.D., University of Oklahoma, 1994 (Chair)

Michael D. DeGrandpre, Ph.D., University of Washington, 1990

Christopher P. Palmer, Ph.D., University of Arizona, 1991

Nigel D. Priestley, Ph.D., Southampton University, 1991

Edward Rosenberg, Ph.,D, Cornell University, 1970

J.B.A. (Sandy) Ross, Ph.D., University of Washington, 1976

Garon C. Smith, Ph.D., Colorado School of Mines, 1983

Kent Sugden, Ph.D., Montana State University, 1992

### **Associate Professors**

- Trina J. Valencich, Ph.D., University of California, Irvine, 1974 (Adjunct)

### **Assistant Professors**

- David Bolstad, Ph.D., The University of Montana, 2006
- Klara Briknarova, Ph.D., Carnegie Mellon University, 1999
- Xi Chu, Ph.D., University of Kansas, 2001
- Valeriy Smirnov, Ph.D., University of Nebraska, 2004

### **Lecturer**

- Holly A. Thompson, Ph.D., Kansas State University, 1982

### **Research Professor**

- Robert Yokelson, Ph.D., Yale University, 1991

### **Research Associate Professors**

- William R. Laws, Ph.D., The Johns Hopkins University, 1977
- Brooke D. Martin, Ph.D., Dartmouth College, 1998

### **Research Assistant Professors**

- Earle R. Adams, Ph.D., Montana State University, 1994
- Ted J. Christian, Ph.D., The University of Montana, 1999

### **Emeritus Professors**

- James W. Cox, Ph.D., Montana State University, 1969
- Ralph J. Fessenden, Ph.D., University of California, 1958
- Richard J. Field, Ph.D., University of Rhode Island, 1968
- Donald E. Kiely, Ph.D., University of Connecticut, 1965
- R. Keith Osterheld, Ph.D., University of Illinois, 1950
- Geoffrey N. Richards, Ph.D., D.Sc., University of Birmingham, 1964
- Wayne P. Van Meter, Ph.D., University of Washington, 1959
- Edward E. Waali, Ph.D., University of Wyoming, 1970
- George W. Woodbury, Jr., Ph.D., University of Minnesota, 1964

## **Department of Communication Studies**

- [Special Degree Requirements](#)
- [Suggested Course of Study](#)
- [Courses](#)
- [Faculty](#)

### **Betsy Wackernagel Bach, Chair**

Communication studies is a growing discipline that is engaged in both social-scientific and humanistic approaches to the analysis, understanding and improvement of human communication. The discipline traces its roots to ancient Greek and Roman studies of the functions of public discourse in society, but in the twentieth century communication came to embrace the studies of interpersonal and small group interaction, human relations in organizations, media and society, and intercultural interaction. Although interdisciplinary in spirit, the discipline has a core of knowledge, theory and concepts concentrating on such things as symbols, messages, interactions, networks, and persuasive campaigns. Uniting the field is the belief that the role of communication in human experience is basic to comprehending complex situations and problems in the modern world. The discipline has roles in both the broad traditions of liberal arts education and in the development and refinement of practical skills.

The Department of Communication Studies at The University of Montana-Missoula focuses on three broad areas of study: interpersonal interaction and human relationships, organizational communication, and rhetoric and public discourse. The knowledge and skills the student may acquire in each of these areas are important to functioning effectively in one's personal life, at work, and as a citizen of the larger society in a rapidly changing world.

The program in Communication Studies helps to prepare students for such diverse professions as: public relations officer, marketing analyst, human resources or personnel manager, community mediator, political speech writer, health communication trainer, social services director, or student services coordinator. Also, undergraduate and graduate study can assist the student in pursuing advanced studies for law, the ministry, and higher education.

### **Admission Requirements**

To be admitted to the communication studies major, a student must complete COMM 111A and two other lower-division COMM courses.

Students who intend to major in communication studies but who have not yet met the above requirements are admitted to the program as pre-communication majors. Pre-communication majors may enroll in 100- and 200-level courses only. Students must be fully admitted as communication studies majors to enroll in 300- and 400-level courses. Before a student can graduate, he or she must meet the requirements to become a communication studies major.

### **Special Degree Requirements**

Refer to graduation requirements listed previously in the catalog. See index.

### **Core Requirements**

To graduate with a degree in communication studies, the student must complete 36 total communication credits with 18 of those credits in courses numbered 300 or above. A maximum of 6 credits in COMM 360 and a maximum of 6 credits in COMM 398 may count toward a major in communication studies. In addition, the following courses are required:

- A course in statistics (does not count toward 36 credits in Communication)
- COMM 110S Introduction to Interpersonal Communication
- COMM 111A Introduction to Public Speaking
- COMM 230S Introduction to Organizational Communication
- COMM 250H Introduction to Rhetorical Theory
- COMM 460 Research Methods

To meet the Upper-division Writing Expectation for a major in Communication Studies, students must successfully complete one of the following courses: COMM 377, COMM 410, COMM 421, COMM 422, COMM 424, COMM 455, COMM 480, COMM 481 or another course approved for this purpose by the University curriculum committee.

### **Allied Fields**

The major is advised to take courses in other academic units throughout the University that will provide an increased understanding of communication, such as anthropology, English, linguistics, management, political science, psychology, social work, and sociology. Of particular interest to students interested in helping professions and associated content areas (e.g., children, families, aging) are the human and family development minor or the minor in gerontology.

Students interested in new communication technology and its use within organizations should consider the media arts minor, while students interested in non-profit organizations should consider the minor in non-profit administration. Students in the rhetoric and public discourse may also opt for the minor in women's and gender studies or climate change. Students are encouraged to consider double majors and minors in a variety of fields that might complement their communication degree.

### **Organizational Communication Option**

Students who elect to concentrate in organizational communication must complete:

All the core requirements listed previously.

At least 5 courses from the following: COMM 240 (Communication in Small Groups), COMM 321 (Introduction to Public Relations), COMM 322 (Public Relations Writing), COMM 412 (Communication and Conflict), COMM 421 (Communication in Nonprofit Organizations), COMM 422 (Communication and Technology in Organizations), COMM 423 (Practical Issues in Organizational Communication), COMM 424 (Risk, Crisis and Communication), and COMM 451S (Intercultural Communication).

3 courses from the following list: ANTH 220S, BADM 100, MGMT 340S; MGMT 344, 368, 440, 457 or 480; MKTG 360, 363, 412; SOCI 306, 345, 371 (SOC 306S, 320, 370S); PSCI 361, 462, 466, 467 (PSC 361, 460, 466 and 467).

Students may petition to count appropriate special topics or transfer courses upon recommendation of the student's advisor. All courses should be selected in consultation with a department faculty advisor.

### **Communication and Human Relationships Option**

Students who elect to concentrate in communication and human relationships must complete:

All the core requirements listed previously.

At least 5 courses from the following: COMM 202S (Nonverbal Communication), 311 (Family Communication), 380 (Gender and Communication), 410 (Communication in Personal Relationships), 412 (Communication and Conflict), and 451S (Intercultural Communication).

At least 4 courses from the following list: ANTH 327, 328S; COUN 485; C&I 355; HFD 412; NAS 342; PSYX 230S, 233, 336, 345, 339, 360S, 385S, 348 (PSYC 240, 245, 336, 340, 350S, 351S, 385); SOCI 220S, 275S, 332, 330, 350 or 382 (SOC 220, 275S, 300, 330S, 340, or 350); SW 300, 420, 422, 460.

Students may petition to count appropriate special topics or transfer courses upon recommendation of the student's advisor. All courses should be selected in consultation with a faculty advisor. Students electing this option are encouraged to minor in Human and Family Development.

### **Rhetoric and Public Discourse Option**

Students who elect to concentrate in rhetoric and public discourse must complete:

All the core requirements listed previously.

At least 4 courses from the following: COMM 241 (Persuasive Communication), 242 (Argumentation), 350 (Persuasive Speaking and Criticism), 377 (Rhetoric, Nature and Environmentalism), 379 (Consumption, Media, and the Environment), 380 (Gender and Communication), and 455 (Rhetorical Criticism and Theory), 480 (The Rhetorical Construction of "Woman"), and 481 (The Rhetoric of U.S. Women's Activism).



At least 4 courses from the following: ANTH 102; CCS 203; ECNS 433 (ECON 440) or EVST 167H, 367, 420, 427; HSTA 102H, 262, 321, 322, 344, 387, 388, or 478; HSTR 272E, 302, 384E, 364 (HIST 152H, 262, 357, 358,362, 370H, 371H 226E, 301H, 335E, 364); MAR 101L; PHIL 211, 471; PSCI 250E, 342, 343, 352, 355, 444, 471 or 474 (PSC 150E, 342, 343, 352, 355, 444, 471 or 472; SOCI 220S, 225, 325, 350, 470, 485 (SOC 220, 225, 325, 340, 470 or 485).

Students may petition to count appropriate special topics or transfer courses upon recommendation of the student's advisor. All courses should be selected in consultation with a faculty advisor.

### Suggested Course of Study

<b>First Year</b>	<b>A</b>	<b>S</b>
COMM 110S Introduction to Interpersonal Communication	-	3
COMM 111A Introduction to Public Speaking	3	-
COMM elective	-	3
WRIT 101 (ENEX 101) Composition	3	-
M 116 (MATH 117) Probability and Linear Mathematics	3	-
General Education	6	9
	15	15
<b>Second Year</b>	<b>A</b>	<b>S</b>
COMM electives	-	9
COMM 230 Organizational Communication	3	-
COMM 250H Introduction to Rhetorical Theory	3	-
STAT 216 (MATH 241) or PSYC 222 (PSYC 220) or SOCI 202 (SOC 202) or HHP 486	3-4	-
General Education	6	-
Electives	2	6
	16-17	15
<b>Third Year</b>	<b>A</b>	<b>S</b>
COMM Writing course	3	-
COMM 460 Communication Research Methods	-	3
Upper-division COMM electives	6	-
Upper-division electives	-	12
Electives	6	-
	15	15
<b>Fourth Year</b>	<b>A</b>	<b>S</b>
Upper-division COMM electives	3	3
Upper-division electives	9	-
Electives	3	11
	15	14

### Requirements for a Minor

To be admitted to the communication studies minor, a student must complete COMM 111A and two other lower-division COMM courses.

Students who intend to minor in communication studies but who have not yet met the above requirements are admitted as pre-communication minors. Pre-communication minors may enroll in 100- and 200-level courses only. Students must be fully admitted as communication studies minors to enroll in 300- and 400-level courses.

Once admitted to earn a minor, the student must complete a minimum of 20 credits in communication studies courses, with at least 9 credits in communication studies courses numbered 300 and above. A maximum of 6 credits in COMM 360 may count toward a minor in communication studies.

### Courses

U = for undergraduate credit only, UG = for undergraduate or graduate credit, G =for graduate credit. R after the credit indicates the course may be repeated for credit to the maximum indicated after the R. Credits beyond this maximum do not count toward a degree.

### Communication Studies (COMM)

**U 110S Introduction to Interpersonal Communication 3 cr.** Offered yearly. An overview of the process of human communication with special emphasis on analyzing communication patterns and improving interpersonal communication skills. Credit not allowed for both COMM 110S and COM 150S.

**U 111A Introduction to Public Speaking 3 cr.** Offered every term. Preparation, presentation, and criticism of speeches. Emphasis on the development of public speaking techniques through constructive criticism. Credit not allowed for both COMM 111A and COM 160A.

**U 173 Language Culture and Society 3 cr.** Offered yearly. Same as LING 173. A survey of the elements of language (structure, meaning, and sound) including language use in its social and cultural contexts.

**U 195 Special Topics Variable cr.** (R-9) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

**U 202S Nonverbal Communication 3 cr.** Offered yearly. Nonverbal code systems and how they function in human communication including gestures, facial expressions, personal space, and others.

**U 220 Professional Communication 3 cr.** Offered intermittently. Principles and practices of effective interviewing in a variety of professional situations including screening of clients and job candidates, performance appraisal, and data-gathering. Advanced public speaking in professional contexts.

**U 230S Organizational Communication 3 cr.** Offered yearly. Theory and research on communication in organizations. Focus on topics such as productivity, power, culture, socialization, technology and globalization covering a wide range of organizations including corporations, government, educational institutions, non-profit agencies and media organizations.

**U 240 Communication in Small Groups 3 cr.** Offered autumn and spring. Theory and research related to communication patterns, cohesion, leadership, and decision-making. Experiences provided in task oriented groups and field analyses of group processes provided.

**U 241 Persuasive Communication 3 cr.** Offered yearly. The use of communication in attitude and behavior change as experienced in personal, organizational, and public contexts.

**U 242 Argumentation 3 cr.** Offered autumn and spring. Prereq., sophomore standing. Development of argumentation skills and critical judgment in decision-making and debate. Includes criticism, construction, presentation, and refutation of spoken and written arguments.

**U 250H Introduction to Rhetorical Theory 3 cr.** Offered yearly. Prereq., COMM 111A. An overview of rhetorical theory including an exploration of classical rhetoric, British and Continental rhetorical theory, and contemporary theories of language and persuasion.

**U 251X International and Development Communication 3 cr.** Offered yearly. International Communication is concerned with information exchange across national borders while Development Communication focuses on the historical, current, and prospective role of communication in social change, improving living conditions, and enhancing life prospects-mainly in developing countries.

**U 260 Communication in the Workplace 3 cr.** Offered intermittently. Explores communication skills needed in business and professional contexts. Focus on developing a working knowledge of theory and skills for interpersonal communication, group communication, and business writing. Concepts include communication processes, diversity in the workplace, nonverbal communication, technical communication, communication with customers, and employment communication. Course objectives are met via Blackboard, the University's online course management system.

**U 295 Special Topics Variable cr.** (R-9) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

**U 311 Family Communication 3 cr.** Offered yearly. Prereq., COMM 110S. An examination of communication in husband-wife, parent-child, and extended family relationships. Topics include intimacy, power, decision-making, problem solving, identity formation, and interpersonal perception.

**U 321 Introduction to Public Relations 3 cr.** Offered yearly. The many uses of communication in the endeavor of public relations. Communication theories and models including interpersonal communication, organizational communication, and mass communication are applied to explore the internal and external communication behaviors associated with public relations.

**U 322 Public Relations Writing 3 cr.** Offered yearly. Prereq., COMM 321 recommended. Writing documents to create relationships between organizations and their public such as press releases, fact sheets, brochures, and speeches.

**U 350 Persuasive Speaking and Criticism 3 cr.** Offered yearly. Prereq., COMM 111A. The persuasive process through the criticism and creation of speeches and other rhetorical artifacts emphasizing the role persuasion plays in creating and shaping our culture.

**U 360 Forensics/Honors 1-3 cr.** (R-12) Offered every term. Prereq., COMM 111A or COMM 242 or equiv. Preparation and participation in competitive speech and debate, including British Parliamentary debate and National Individual Events Tournament (NIET) speeches. The team travels to regional competitions and hosts on-campus and intramural debates and speaking events. Up to 6 credits may apply toward a major or minor in communication studies.

**U 377 Rhetoric, Nature and Environmentalism 3 cr.** Offered every other year. Same as EVST 377. Survey of rhetorical texts that shape public understanding of nature and environmental issues. Analysis of a range of historical and contemporary environmental texts using theoretical concepts from the rhetorical tradition.

**U 379 Communication, Consumption and Climate 3 cr.** Offered every other year. Same as EVST 379 and CCS 379. Analyzes consumption as a communication practice, investigates discourses that promote consumption, and illuminates environmental impacts on consumption.

**U 380 Gender and Communication 3 cr.** Offered yearly. Same as WGS 380. The meaning of gender in our culture and how gender is displayed and perpetuated through our private and public verbal and nonverbal interactions.

**U 395 Special Topics Variable cr.** (R-9) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

**U 398 Internship Variable cr.** (R-6) Offered autumn and spring. Prereq., consent of instr. Extended classroom experience that provides practical application of classroom learning during placements off campus. Prior approval must be obtained from the faculty supervisor and the Internship Services office. A maximum of 6 credits of Internship (198, 298, 398, 498) may count toward graduation. Offered C/NCR only.

**UG 410 Communication in Personal Relationships 3 cr.** Offered yearly. Prereq., COMM 110S. An examination of the functions, types, and historical context of close personal relationships with an in-depth study of the role of communication in friendships and romantic relations.

**UG 412 Communication and Conflict 3 cr.** Offered autumn and spring. Conceptual and practical discussions of communication and conflict in interpersonal relationships, organizational settings and overall cultural milieu. Topics include culture, power, styles, negotiation and bargaining, mediation, dissent, dispute systems, and crisis communication.

**UG 421 Communication in Nonprofit Organization 3 cr.** Offered yearly. Prereq., COMM 230S. Focuses on issues in nonprofit organizational communication at macro and micro levels. Topics include: organizational identity, change processes, public relations, fund-raising, advocacy, socialization, stress and burnout, board management and professionalization.

**UG 422 Communication and Technology in Organizations 3 cr.** Offered every other year. Prereq., COMM 230S. This course takes a critical look at the influence of communication technologies on organizational communication. Students will examine how the world of work is changing due to new technologies and explore the social and ethical implications of technical innovation, adoption and use.

**UG 423 Practical Issues in Organizational Communication 3 cr.** Offered every other year. Prereq., COMM 230S. Emphasis on the theoretical and practical issues involved in communication training and consultation. Overview of theoretical models followed by the "nuts and bolts" of communication training and consultation. Students will carry out a training or consultation project (e.g., planning, execution, and evaluation) to sharpen the issues explored.

**UG 424 Risk, Crisis and Communication 3cr.** Offered every other year. This course explores the communicative dynamics that both prevent and cause organizational crisis. Through case studies, the class examines how people plan, communicate and make good decisions in high-risk situations, as well as how to manage crisis public relations effectively.

**UG 451S Intercultural Communication 3 cr.** Offered autumn and spring. Communication principles and processes in cross-cultural environments. Non-Western cultures are emphasized by contrasting them to Western communication norms.

**U 455 Rhetorical Criticism and Theory 3 cr.** Offered intermittently. Introduction to study of rhetorical criticism and theory. Current theoretical and methodological issues and approaches including traditional criticism, experiential criticism, dramatism, narrative criticism, feminist criticism, postmodern criticism.

**UG 460 Communication Research Methods 3 cr.** Offered autumn and spring. Prereq., a course in statistics. Introduction to the major types of communication research and the foundations of quantitative research methods.

**UG 461 Research Seminar 1-3 cr.** (R-9) Offered autumn and spring. Prereq., COMM 460 and consent of instr. Application of quantitative and qualitative research methods to specialized contexts. Emphasis on direct student involvement in research activities.

**G 480 The Rhetorical Construction of "Woman" 3 cr.** Offered every other year. Same as WGS 480. Topics include the early women's rights conventions, debates over marriage and divorce, social feminism, woman suffrage in Montana, and intersections between gender and race.

**UG 481 The Rhetoric of U.S. Women's Activism, 1960-Present 3 cr.** Offered every other year. Same as WGS 481. Explores the rhetoric surrounding contemporary women's social "activism" in the U.S. Topics include women's rights, women's liberation, consciousness raising as a rhetorical form, reproductive rights, sexuality, and intersections between gender, race, and class.

**UG 495 Special Topics Variable cr.** (R-9) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

**UG 496 Independent Study Variable cr.** (R-9) Offered every term. Prereq., consent of instr. Offered C/NCR only.

**G 510 Seminar in Personal Relationships 3 cr.** (R-6) Offered yearly. Prereq., consent of instr. Examines theory and research on the process and functions of communication in personal relationship contexts. Interdisciplinary reading illuminates the dynamics of

communication in the development, maintenance, and deterioration of romantic relationships, friendships, and family relationships. Discussion and assignments center around theoretical, methodological, and practical issues in research on communicative activities and events in personal relationships.

**G 511 Survey of Interpersonal Communication 3 cr.** Offered every other year. Prereq., graduate standing in communication studies or consent of instr. Survey of theories and research in interpersonal communication including definitions of interpersonal communication, its place in the field of communication, and methodological issues. Overall emphasis on foundational readings and recent research developments.

**G 512 Seminar in Interpersonal Conflict 3 cr.** (R-6) Offered intermittently. Prereq., consent of instr.

**G 514 Alternative Dispute Resolution 3 cr.** Offered yearly. Same as LAW 614. A study of the varieties of dispute resolution vehicles outside the court process. Focus on a 40-hour component of practical skills training for the mediation practitioner. Topics include the mediation model, interest-based negotiation and effective communication.

**G 520 Seminar in Organizational Communication 3 cr.** Offered every other year. (R-6) Prereq., consent of instr. Introduction to theories and research in organizational communication. Topics include culture, networks, structure, technology, identity, power, resistance, gender, and globalization. Overall emphasis on foundational readings and recent research developments.

**G 540 Seminar in Instructional Communication 3 cr.** Offered every other year. Prereq., consent of instr. Instruction in the theories, concepts, principles, and skills employed university level classroom communication and instruction.

**G 541 Teaching the Basic Course 2 cr.** (R-8) Offered autumn and spring. Prereq., consent of instr. Offered C/NCR only.

**G 555 Seminar in Rhetorical Criticism and Theory 3 cr.** Offered every other year. Introduction to contemporary issues in rhetorical criticism and theory. Topics include classical criticism, dramatism, close textual analysis, ideographic criticism, narrative criticism, feminist criticism, and postmodern criticism.

**G 561 Qualitative Research Methods 3 cr.** Offered every year. An emphasis on the philosophy and practice of qualitative inquiry, the development and use of descriptive frameworks, and gathering and testing qualitative data to develop human communication theory.

**G 572 Family Law Mediation 2 cr.** Offered autumn. Same as LAW 672. Interdisciplinary course on advanced mediation skills with a focus on family mediation including divorce and other types of family problems. Psychological issues for both children and parents, power balancing, gender issues and interest-based negotiation model.

**G 575 Seminar in Rhetoric and Environmental Controversy 3 cr.** Offered every other year. Same as EVST 575. The study of how advocates use symbols to influence meaning and action in environmental controversies. Rhetorical concepts used to examine recurring strategies and tactics in specific controversies.

**G 585 Communication Across the Sciences 3 cr.** Offered yearly. Focus on communication practices that facilitate interdisciplinary interactions across the sciences and result in more competent communication. Offered only to graduate student trainees enrolled in the M-EID program.

**G 593 Professional Paper Variable cr.** (R-6) Offered every term. Prereq., consent of instr.

**G 594 Topical Seminar Variable cr.** (R-6) Offered intermittently. Prereq., consent of instr.

**G 595 Special Topics Variable cr.** (R-9) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

**G 596 Independent Study Variable cr.** (R-9) Offered every term. Prereq., consent of instr.

**G 599 Thesis Variable cr.** (R-9) Offered every term. Prereq., consent of instr.

## Faculty

### Professors

- Sara E. Hayden, Ph.D., University of Minnesota, 1994
- Alan L. Sillars, Ph.D., University of Wisconsin, 1980
- Betsy Wackernagel Bach, Ph.D., University of Washington, 1985 (Chair)

### Associate Professors

- Greg Larson, Ph.D., University of Colorado, 2000
- Steve Schwarze, Ph.D., The University of Iowa, 1999
- Stephen M. Yoshimura, Ph.D., Arizona State University, 2002

## Assistant Professors

- Joel Iverson, Ph.D., Arizona State University, 2003
- Christina Yoshimura, Ph.D., Arizona State University, 2004

## Adjunct Instructor

- Phyllis Bo-yuen Ngai, Ed.D., The University of Montana, 2004

## Emeritus Professor

- William W. Wilmot, Ph.D., University of Washington, 1970

## Emeritus Associate Professor

- James H. Polsin, Ph.D., University of Kansas, 1971

# Comparative Literature

## Robert Baker (Assistant Professor of English), Chair, Comparative Literature Committee

Comparative literature is the study of literature beyond the confines of one national literature. It is especially concerned with the similarities and differences which can be observed in literary works in different languages. It makes comparisons from various points of view, studying, for example, movements, periods, genres and themes in two or more national literatures. Certain types of comparative literature studies can be highly useful to students in such fields as psychology, philosophy, anthropology and history, as well as to majors in English and modern and classical languages and literatures.

Students interested in working toward a degree in comparative literature (not offered by this University) should bear in mind that a knowledge of at least two foreign languages is indispensable for advanced work. Courses in comparative literature topics are offered at The University of Montana-Missoula in several departments: English, Drama, Philosophy, Liberal Studies, Modern and Classical Languages and Literatures, Native American Studies, and Asian Studies. For advising see the chair.

# Department of Computer Science

- [Special Degree Requirements](#)
- [Suggested Course of Study](#)
- [Courses](#)
- [Faculty](#)

## Joel Henry, Chairman

The growing utility of computers in research and education, as well as the increased impact of computers on our modern society, strongly implies that knowledge of computers and their capabilities should be a part of the basic education of all students. The courses listed below are designed to provide the student with this knowledge and to prepare the student for a career in a field in which there is a growing need for trained personnel. The objective of the undergraduate curriculum in computer science is to teach theory and to develop professionally competent, broadly educated computer scientists who wish to pursue professional careers or graduate studies.

The B.S. program is accredited by the Computing Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 - Telephone: 410-347-7700. For more information access our homepage <http://www.cs.umt.edu> or email the chairman at [joel.henry@umontana.edu](mailto:joel.henry@umontana.edu).

**High School Preparation:** In addition to general University admission requirements, pre-college preparation should include as many computer science courses as possible, and four years of high school mathematics, to include algebra, trigonometry and pre-calculus. Also recommended are physics and chemistry.

## Admission Requirements

Admission to computer science courses varies according to course level and other departmental standards. However, students must have completed all prerequisite courses with a grade of at least a "C-".

## Lower-Division Courses

Most 100- and 200-level courses are open on a first-come, first-served basis to all students who have the prerequisites. Students taking computer science courses to satisfy a general education symbolic system sequence should normally take CS 101-131, CS 131-132, or CS 133.

## Upper-Division Courses

Admission to 300-level or above courses requires successful completion of the prerequisites.

## Major-Minor Status

Completed change of major forms along with college transcripts must be turned in to the department when declaring computer science as a major or minor.

## Special Degree Requirements

To locate graduation requirements in addition to those of the Computer Science Department, see "graduation requirements" in the index of this catalog.

### Bachelor of Science degree with a major in Computer Science

A B.S. degree in computer science requires completion of the following requirements with at least a "C-" in each course (2.00 grade point average required):

**Computer Science.** CS 121, CS 131-132 or CS 133, CS 241, CS 242, CS 281, CS 332, CS 344, CS 346, CS 365, CS 415, CS 441, CS 442, CS 488, and nine credits of CS electives selected from courses numbered 300 and above.

**Mathematics.** M 171-172, 221 or 325, 225 & Stat 341 (MATH 152-153, 221 or 325, 225, and 341).

**Writing/Communication.** Students must take FOR 220. Students must also take COMM 111A or COMM 242.

**Science.** Students must take one of the sequences BIOL 108N-109N, 110N; CHMY 141N, 143N (CHEM 161N, 162N); or PHYS 211N/213N and 212N/214N.

Students also must take two additional courses selected from the following list (two numbers separated by a / means that the second number is a lab for the first and the two together only count as one course for this requirement):

- ASTR 131N/134N, ASTR 132N/135N
- BIOL 106N/107N, BIOL 108N/109N, BIOL 110N
- CHMY 141N, 143N (CHEM 161N, CHEM 162N)
- FOR 201
- GEO 101N, 102N (GEOS 100N/101N), GEO 226 (GEOS 226)
- PHYS 211N/213N, PHYS 212N/214N, PHYS 341, PHYS 444

NOTE: 100-level CS courses other than CS 121, CS 131-132, CS 133 and 200-level CS courses other than CS 241-242 and CS 281 do not count toward the degree or option requirements. However, they do count in the 60 credit limit in the major.

## Upper-division Writing Expectation

Upper-division Writing Expectation for Computer Science majors is CS 415.

## Social Science, Humanities, Arts and Other Disciplines

Students must take 30 credits in social science, humanities, arts or disciplines other than computer science, mathematics and science. The courses taken to meet the Writing/Communication requirement can also count towards this requirement.

### Bachelor of Science degree with a combined major in Computer Science-Mathematical Sciences

The purpose for the combined program is to provide a thorough background in both allied disciplines and to inculcate a deeper understanding of their goals and methods. A student must complete 60 credits in the two disciplines: 30 of these credits in computer science courses and 30 of these credits in mathematical sciences courses. A minimum grade of "C-" and a 2.0 grade point average is required in all courses which follow:

**The computer science requirements are:** 121, 131-132 or 133, 241-242, 281, 332, and nine credits of CS electives selected from courses numbered 300 and above. A total of at most three of the nine credits of CS electives may be in CS 398 or 498.

**The mathematical sciences requirements are:** M 171 (or 181)-172 (or 182), 221, 273, 307 or (225) (MATH 152-153, 221, 251, 305 (or 225)), and twelve credits of mathematical sciences selected from the following list: M 311, 325, 326, 361, 362, 381, 412, 414, 429, 431, 432, 439, 440, 445, 472, 473, 485 and STAT 341, 421, 422, 451, 452 (MATH 311, 325, 326, 341, 351, 381, 382, 406, 412, 414, 421, 422, 431, 441, 442, 444, 445, 451, 452, 471, 475, 485).

The combined nine additional credits of computer science electives and twelve additional credits of mathematical sciences electives must include at least three 3- or 4-credit courses numbered 400 or above, with at least one chosen from each department (not including M 429,

STAT 451 and 452 (MATH 406, 444, and 445)).

**Other requirements are:** One of the sequences BIOL 108N-109N, 110N; or CHMY 141N, 143N (CHEM 161N, 162N); or PHYS 211N/213N and 212N/214N. In addition, WRIT 222 (FOR 220), and either COMM 111A or COMM 242.

Each student plans a program in consultation with a computer science and a mathematical sciences advisor. Students planning to attend graduate school in computer science or the mathematical sciences should consult with their respective advisors.

**Suggested Curricula:**

**Applied Math-Scientific Programming:** M 311, 412, 414 (MATH 311, 412, 414), and one course chosen from STAT 341 (MATH 341), M 381, 473, 472, 440 (MATH 351, 451, 452, 471). Three courses chosen from CS 344, 446, 477 and 486.

**Combinatorics and Optimization-Artificial Intelligence:** M 361, 362 (MATH 381, 382); two courses chosen from M 325, 414, 485, STAT 341 (MATH 325, 341, 414, 485); and CS 344, 455, and 457.

**Statistics-Machine Learning:** STAT 341, 421 (MATH 341, 441), and two courses chosen from M 325, 362, 485, STAT 422 (MATH 325, 382, 442, 485); three courses chosen from CS 365, 455, 457, 458 and 486.

**Algebra-Analysis:** M 381, 431 (MATH 351, 421), and two courses chosen from M 326, 432, 473, 472 (MATH 326, 422, 451, 452); CS 344, 441, and one other course.

**Suggested Course of Study**

	<b>First Year</b>	<b>A</b>	<b>S</b>
CS 121 Careers in Computer Science		1	-
CS 131-132 Fundamentals of Computer Science I, II or CS 133 Accelerated Fundamentals of Computer Science (3 cr. - one semester)		3	3
COMM 111A Introduction to Public Speaking		3	-
WRIT 101 (ENEX 101) College Writing I		-	3
M 171, 172 (MATH 152-153) Calculus I, II		4	4
Electives and General Education		3	6
Total		14	16
	<b>Second Year</b>	<b>A</b>	<b>S</b>
CS 241 Data Structures		4	-
CS 242 Programming Languages		-	4
CS 281 Computer Architecture		3	-
M 225 (MATH 225) Discrete Math I		3	-
M 221 (MATH 221) Linear Algebra		-	4
Science sequence		5	5
Electives and General Education		-	3
Total		15	16
	<b>Third Year**</b>	<b>A</b>	<b>S</b>
CS 332 Algorithms		3	-
CS 344 Operating Systems		3	-
CS 346 Software Science		-	3
CS 365 Database Design and DBMS		-	3
CS 488 Computer Networks		-	3
WRIT 222 (FOR 220) Technical Approach to Writing		-	2
STAT 341 (MATH 341) Introduction to Probability and Statistics		3	-
Science Electives		3	3
Electives and General Education		3	-
Total		15	14
	<b>Fourth Year**</b>	<b>A</b>	<b>S</b>
CS 415 Computers, Ethics, and Society***		3	-
CS 441 Theory and Practice I		3	-
CS 442 Theory and Practice II		-	3
CS option courses and electives		3	6
Electives and General Education		6	6
Total		15	15

\*\*CS core courses at the 300- and 400-level may not always be offered in the sequence shown but will be offered every year.

\*\*\*Students must pass the upper-division writing proficiency assessment before taking CS 415.

## Requirements for a Minor

There are two minors offered by the Department of Computer Science: the traditional minor in computer science emphasizes computer programming and related skills, while the minor in computer applications emphasizes use of applications such as programming languages, word processors, spreadsheets, and data bases in the management and manipulation of electronic information.

**Computer Science:** To earn a minor in computer science the student must complete (with at least a "C-" in each course and a 2.00 grade average) 18 CS credits including:

1. Either CS 131-132 or CS 133.
2. Elective Courses chosen from CS 101, 177, 181, 241, 242 and one course number 300 and above. CS 101 and 177 cannot both be counted as electives, and at least 6 credits of elective must be at the 300 level or above.

**Computer Applications:** To earn a minor in computer applications, a student must complete (with at least a "C-" grade in each course and a 2.00 grade average) 21 CS credits including:

1. At least one and no more than three of CS 101, CS 131, CS 201, CS 207.
2. At least one and no more than three of CS 111, CAPP 171, CS 172, CS 177, and CS 181.
3. Remaining courses must be selected from CS 131-132, CS 241-242, CS 486, other CS major courses, pre-approved CS 195, CS 295, CS 395, or CS 495 special topics courses, or up to six credits of pre-approved classes outside the department.

## Courses

U = for undergraduate credit only, UG = for undergraduate or graduate credit, G = for graduate credit. R after the credit indicates the course may be repeated for credit to the maximum indicated after the R. Credits beyond this maximum do not count toward a degree.

### Computer Science (CS)

Students taking CS classes with computer programming components should expect to use additional computer lab time outside of class.

- **U 101 Introduction to Programming 3 cr.** Offered every term. Elementary programming techniques using the Visual BASIC programming language. A wide range of primarily nonmathematical programs will be written by the student and run on a computer. (Two hours independent lab per week.) Credit not allowed for both CS 101 and CRT 121.
- **U 102 Introduction to Object-Oriented Programming 1 cr.** Offered every term. Classes are held for 2 hours/week in the first half of the semester. Introduction to object-oriented programming using a visual programming environment. Students create programs using drag-and-drop and these programs control animated on-screen characters and objects. Course is designed as a supplement to CS 131-132 which teaches object-oriented programming in a more traditional manner.
- **U 111 Fluency with Information Technology 3 cr.** Offered intermittently. Introduces the skills and concepts of information technology, both from practical and more theoretical points of view. During lectures and interactive computer labs, students explore a wide range of digital and information technologies, including common PC applications, networking, databases, privacy, and security.
- **U 121 Careers in Computer Science 1 cr.** Offered autumn. Exploration of various careers available in the general area of Computer Science. Includes discussion of strategies for success in the major. Computer Science faculty members also will discuss possible undergraduate research opportunities and motivation for graduate education.
- **U 131 Fundamentals of Computer Science I 3 cr.** Offered autumn and spring. Prereq., computer programming experience in a language such as BASIC, Pascal, C, etc.; coreq., M 095 (MAT 100D) or consent of instr. CS 102 highly recommended as prereq. or coreq. Fundamental computer science concepts using the high level structured programming language, Java.
- **U 132 Fundamentals of Computer Science II 3 cr.** Offered autumn, spring, and summer. Prereq., CS 131; coreq., MATH 121 or consent of instr. Continuation of CS 131. Survey of computer science topics including recursion, algorithms, basic data structures, operating systems, artificial intelligence, graphics, user interfaces, and social and ethical implications of computing.
- **U 133 Accelerated Fundamentals of Computer Science 3 cr.** Offered autumn and spring. Prereq., computer programming in a language such as BASIC, C, C++, etc.; coreq., M 151 (MATH 121) or consent of instr. A one-semester combination of CS 131 and CS 132; fundamental computer science concepts using Java, and a survey of computer science topics (software engineering, recursion, algorithms, basic data structures, operating systems, artificial systems, graphics, user interfaces, and social and ethical implications of computing).
- **U 172 Introduction to Computer Modeling 3 cr.** Offered every term. Prereq., previous computer experience and M 095 (MAT 100D) or equiv. score on math placement test, or consent of instr. Problem solving with spreadsheets and databases using the computer to analyze a set of data; presentation of results of analysis. Credit not allowed for CRT 172 and this course.
- **U 177 Computer Modeling for Science Majors 3 cr.** Offered spring. Prereq., basic computer and spreadsheet literacy; coreq., M 162 or 171 (MATH 150 or 152). An introduction to computer modeling in the sciences using spreadsheets and a programming language. Integrates principles of math, computer science and science. A student can take at most one of CS 172, CS 177, CRT 280, and CRT 281 for credit.
- **U 181 Electronic Publishing on the World Wide Web 3 cr.** Offered every term. Prereq., CS 111 or consent of instr. Introduction to browsers and the World Wide Web. Web site design and construction facilitated by the use of several multimedia programs. HTML and SGML explained in the use of web construction. Copyright issues and other WWW services are discussed.



- **U 195 Special Topics Variable cr.** (R-6) Offered intermittently. Prereq., consent of instr. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.
- **U 196 Independent Study Variable cr.**(R-6) Offered intermittently. Prereq., consent of instr.
- **U 198 Internship Variable cr.** Offered intermittently. Prereq., consent of department. Extended classroom experience which provides practical application of classroom learning during placements on and off campus. Prior approval must be obtained from the faculty supervisor and the Internship Services office. A maximum of 6 credits of Internship (198, 298, 398, 498) may count toward graduation.
- **U 201 Special Programming Languages 3 cr.** (R-open) Offered intermittently. Prereq., depends on specific language offered. Computer programming using a high-level programming language which is not taught in a regular language-specific course. Can be repeated by choosing different languages.
- **U 207 Advanced Visual BASIC Programming 3 cr.** Offered intermittently. Prereq., CS 101 or consent of instr. Advanced applications programming in Visual BASIC. Topics include advanced objects and controls, web page development, and language trends.
- **U 241 Data Structures 4 cr.** Offered autumn. Prereq., CS 132; coreq., M 225 (MATH 225) or consent of instr. Abstract data types, recursion, linked lists, trees, hashing, graphs, and applications of data structures in algorithm development. Emphasis on object oriented programming techniques.
- **U 242 Programming Languages 4 cr.** Offered spring. Prereq., CS 241 and M 225 (MATH 225). Concepts and principles of programming languages with an emphasis on C, C++, and object-oriented programming. Syntax and semantics of object-oriented languages. Principles and implementation of late binding, memory allocation and de-allocation, type-checking, scope, polymorphism, inheritance.
- **U 281 Computer Architecture and Assembly Language Programming 3 cr.** Offered autumn. Prereq., CS 132 or consent of instr. Functional view of computer system components, BCPU, ALU, memory, bus, cache, I/O module. Instruction set design: formats, addressing modes. Basic circuit design. Pipelining and assembly language. Interrupt handling. Implementation of ALU and control unit. Detailed design of an RISC-like instruction set. Datapath and performance comparisons. Basic multiprocessor design.
- **U 295 Special Topics Variable cr.** (R-6) Offered intermittently. Prereq., consent of instr. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.
- **U 296 Independent Study Variable cr.** (R-6) Offered intermittently. Prereq., consent of instr.
- **U 298 Internship Variable cr.** (R-6) Offered intermittently. Prereq., consent of department. Extended classroom experience which provides practical application of classroom learning during placements on and off campus. Prior approval must be obtained from the faculty supervisor and the Internship Services office. A maximum of 6 credits of Internship (198, 298, 398, 498) may count toward graduation.
- **U 332 Algorithms 3 cr.** Offered autumn. Prereq., CS 241 and M 225 (MATH 225) or consent of instr. Algorithm design, analysis, and correctness. Commonly used algorithms including searching and sorting, string search, dynamic programming, branch and bound, graph algorithms, and parallel algorithms. Introduction to NP-complete problems.
- **U 344 Operating Systems 3 cr.** Offered autumn. Prereq., CS 241, 242, CS 281, or consent of instr. Operating system design principles. Processes, threads, synchronization, deadlock, memory management, file management and file systems, protection, and security. Comparison of commonly used existing operating systems. Writing programs that make use of operating system services.
- **U 346 Software Engineering 3 cr.** Offered spring. Prereq., CS 132. Study, implementation, and assessment of software processes, techniques, methods, and CASE tools. Project management and cost estimation techniques will be examined. A group project may be required.
- **U 365 Database Design and Database Management Systems 3 cr.** Offered spring. Prereq., CS 241 or consent of instr. Fundamentals of data modeling, the relational mode, normal forms, file organization, index structures and SQL. Major project involving the design and implementation of a relational database.
- **U 394 Seminar Variable cr.** (R-6) Offered intermittently. Prereq., consent of instr. Guidance in special work.
- **U 395 Special Topics Variable cr.** (R-6) Offered intermittently. Prereq., junior standing. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.
- **U 396 Independent Study Variable cr.** (R-6) Offered intermittently. Prereq., consent of instr.
- **U 397 Research Variable cr.** (R-6) Offered intermittently. Prereq., consent of instr.
- **U 398 Internship Variable cr.** (R-3) Offered intermittently. Prereq., consent of department. Business or government internship. Prior approval must be obtained from faculty supervisor and the Internship Services office. Only three credits applicable to computer science major or minor. A maximum of 6 credits of Internship (198, 298, 398, 498) may count toward graduation.
- **U 415 Computers, Ethics, and Society 3 cr.** Offered autumn. Prereq., computer science or computer science/math major with senior standing, FOR 220, successful completion of the Upper-Division Writing Proficiency Assessment, or consent of instr. Ethical problems that face computer scientists. The codes of ethics of computing professional societies. The social implications of computers, computing, and other digital technologies.
- **U 435 Web Programming 3 cr.** Offered spring. Prereq., CS 241 or consent of instr. Programming and software development techniques for developing web-based applications. Scripting and other programming languages that are used for web-based development.
- **UG 441 Advanced Programming: Theory and Practice I 3 cr.** Offered autumn. Prereq., CS 242, 344, 346, 365 and M 225 (MATH 225), or consent of instr. Examination and implementation of modern best practices in the areas of software design, coding, testing and maintenance. Focus on design patterns and design pattern languages used to build modern software systems in a variety of areas.
- **UG 442 Advanced Programming: Theory and Practice II 3 cr.** Offered spring. Prereq., CS 441. Design and implementation of a major software project in a group setting, with required documentation, presentation, installation, and approval by the instructor.
- **UG 446 Computer Graphics 3 cr.** Offered intermittently. Prereq., CS 241 and M 221 (MATH 221) or consent of instr. Hardware and software elements of graphics systems. Basic computer graphics algorithms for transformations, clipping, windowing and polygon filling. Straight line, circle generation. Parametrical representations of curves and surfaces. Three-D viewing. Hidden line and surface removal, shading and color models.