

tribution, behavior and adaptation of birds, within an ecological and evolutionary context. Includes laboratory and field identification, with emphasis on Michigan fauna. Three hours of lecture, three hours of laboratory per week. (Prerequisite: Biology 212.) Spring, May or Summer.

381. Mammalogy (4). The principles of classification, distribution, behavior and adaptation of mammals, within an ecological and evolutionary context. Includes laboratory and field identification, with emphasis on Michigan fauna. Three hours of lecture, three hours of laboratory per week. (Prerequisite: Biology 212.) Spring, May or Summer.

401. Senior Seminar (1). Student-led discussions of recent advances in biological research. One hour per week. (Open only to senior biology majors and 3 + 1 program students with department chairperson's permission.) Fall, spring.

455. Human Anatomy (3). Dissection and the anatomical exploration of the human body using cadavers. Two hours of lecture and two hours of laboratory per week. (Prerequisite: Biology majors with junior or senior standing and permission of instructor.) Spring.

Special and Advanced Courses

199. Exploratory Internship (1-3).

299. Experimental Course (1-4).

399. Professional Internship (1-12). Previously approved internships include hospital observational experience and work at Kalamazoo Nature Center and Hidden Lake Gardens.

450. Biological Research (1-2). Original research in biology requiring acceptance of a thesis proposal by the biology faculty prior to registration. Proposal must include literature survey, budget and time scale for completion of each segment. May be repeated. (Prerequisite: Permission of instructor.) Fall, spring.

451. Independent Study (1-3). Independent study in biology that is supervised by a biology faculty member. May be repeated. (Prerequisite: permission of instructor.)

499. Advanced Experimental Course (1-4).

Chemistry

A chemistry major enters such fields as chemical research, industrial chemistry, medicine, dentistry and education. The chemistry department offers programs leading to either a Bachelor of Arts or Bachelor of Science degree. Those who intend to enter graduate study are encouraged to earn the Bachelor of Science degree.

Major Program Requirements

Bachelor of Arts in Chemistry

(33-34 hours of Chemistry and 23 hours of cognates)

Chemistry B.A. Core (30 hours)

CHEM 103, 104 College Chemistry (4, 4)

CHEM 201 Sophomore Seminar (1)
CHEM 301 Junior Seminar (1)
CHEM 303 Quantitative Analysis (3)
CHEM 304 Quantitative Analysis Laboratory (2)
CHEM 311, 312 Organic Chemistry (3, 3)
CHEM 313, 314 Organic Chemistry Laboratory (1,1)
CHEM 321, 322 Physical Chemistry (3, 3)
CHEM 323, 324 Physical Chemistry Laboratory (1,1)
CHEM 401 Senior Seminar (1)

Chemistry B.A. Electives (3-4 hours)

One of the following:

CHEM 402, 404, 405 or 406

Chemistry B.A. Cognates (23 hours)

CIS 106 Computer Programming (3)
MATH 115 Pre-Calculus Mathematics (4)
MATH 135, 205 Calculus I, II (4, 4)
PHYS 101, 102* Introductory Physics I, II (3, 3)
PHYS 103, 104* Introductory Physics Lab I, II (1, 1)

*8 hours of higher-level physics may be substituted for the Introductory Physics requirement.

Bachelor of Science in Chemistry

(38 hours in Chemistry and 26-27 hours of cognates)

Chemistry B.S. Core (38 hours)

CHEM 103, 104 College Chemistry (4, 4)
CHEM 201 Sophomore Seminar (1)
CHEM 301 Seminar (1)
CHEM 303 Quantitative Analysis (3)
CHEM 304 Quantitative Analysis Laboratory (2)
CHEM 311, 312 Organic Chemistry (3, 3)
CHEM 313, 314 Organic Chemistry Laboratory (1,1)
CHEM 321, 322 Physical Chemistry (3, 3)
CHEM 323, 324 Physical Chemistry Laboratory (1,1)
CHEM 401 Senior Seminar (1)
CHEM 402 Instrumental Analysis (4)
CHEM 404 Advanced Inorganic Chemistry (3)
CHEM 450 Research (1)
or CHEM 451 Independent Study (1)

Chemistry B.S. Cognates (26-27 hours)

CIS 106 Computer Programming (3)
MATH 115 Pre-Calculus Mathematics (4)
MATH 135, 205 Calculus I, II (4, 4)
MATH 215 Calculus III (4)
or 3 hours of 300-level Mathematics
PHYS 205, 206 General Physics I, II (3,3)
2 hours of Physics laboratory (200+ level) (2)

A student majoring in chemistry who plans to enter medical or dental school should contact the pre-health science advisor.

Bachelor of Arts with Teacher Certification in Chemistry

See the Teacher Education section of the catalog.

Minor Program Requirements

A student minoring in chemistry will complete a minimum

of 20 semester hours in the department, including Chemistry 103, 104 and 303, 304 and one of the following sequences of courses:

CHEM 311, 312, 313 and 314; or

two of the following three:

CHEM 321 and 323, CHEM 322 and 324 or CHEM 402.

Additional courses required for the minor are Mathematics 115 and Physics 101, 102, 103, 104 or eight hours of equivalent higher-level physics courses.

A student seeking to graduate with departmental honors in chemistry must maintain a minimum 3.0 grade point average in science courses and complete the Bachelor of Science program along with 5 additional hours of course work in the department, including either Chemistry 405 or 406.

A grade of C- or better is required in all prerequisite chemistry courses.

The semesters listed after course descriptions indicate when courses are expected to be offered. Schedules are subject to change; students should confirm semester offerings with the department when planning degree programs.

101. The World of Chemistry (NATURAL SCIENCE) (4) Intended for the non-science major, this course will introduce concepts of chemistry by relating them to their daily uses. Hands-on learning is emphasized through classroom and laboratory activities, showing the interplay of theory and experiment, and how they relate to the scientific method. (Does not count toward a Chemistry major or minor.) Three lectures, one 3-hour laboratory per week. Fall.

103, 104. College Chemistry (NATURAL SCIENCE for 103) (4, 4). An introductory sequence for chemistry majors, students in biology, earth science, physics, chemical engineering, pre-medicine and pre-dentistry and others who want a comprehensive introduction. Topics include laws of chemical combination, gas laws, atomic structure, the periodic system, kinetics, chemical equilibrium and oxidation-reduction. Laboratory experiments are designed to illustrate these basic concepts and the use of modern chemical instrumentation. Three lectures, one discussion period, one 3-hour laboratory period per week. (Corequisite: Mathematics 101; High school chemistry is strongly recommended. Chemistry 103 or instructor's permission is prerequisite for 104.) Fall, spring.

201. Sophomore Seminar (1). Required of all sophomore Chemistry majors. Exploring topics in the chemical literature and career opportunities in Chemistry through discussion and oral presentation. (Prerequisite: Chemistry 103, 104.)

202. Issues in Science (3). Explores the human side of science (biographies, diversity, ethics, history). Enriches the students' perspective on the role of science and technology in shaping society and prepares them for careers as responsible scientists.

204. Environmental Chemistry (4). Application of basic concepts of Chemistry to issues of air, water and soil pollution. The chemistry of energy generation and its environmental implications are also discussed. Three lectures, one 3-hour laboratory period per week. (Prerequisite: Chemistry 104 or instructor's permission.) Offered as needed.

214. Chemical Demonstrations (1). The theory and practice of performing classroom demonstrations exhibiting chemical principles. Students are required to participate in a community outreach program as part of their final evaluation. (Prerequisite: Chemistry 104.) (May be repeated.)

222. Scientific Writing (4). Focuses on skills necessary for writing in the social and physical sciences. Students will read and create a variety of documents, including lab notes, reports, summaries, and abstracts. Significant library and internet research, which students will use to write technical descriptions, literature reviews, instructions, and essays. (Prerequisite: ENGL 101.) Offered as needed.

301. Junior Seminar (1). A course designed to acquaint students with methods of searching the chemical literature and to provide them with an opportunity to prepare research material for a scientific paper and poster presentation. Topics selected will depend upon the special interests of participating faculty members and students. (Prerequisite: Chemistry 201.) Fall.

303. Quantitative Analysis (3). The study of chemical stoichiometry and equilibria, including elementary principles of volumetric, gravimetric, spectrophotometric and potentiometric analysis as applied to chemical analysis. Three lectures, one discussion, two 3-hour laboratory periods per week. (Prerequisites: Mathematics 115, and Chemistry 104 or instructor's permission.) Fall.

304. Quantitative Analysis Laboratory (2). Laboratory experiments to develop skills and learn applications within the analytical chemistry laboratory. Two 3-hour laboratory sessions per week. (Prerequisites: Chemistry 302). Spring.

309. Special Problems (1). An introduction to methods of chemical research. May be repeated. (Prerequisite: instructor's permission.) Fall, spring.

311, 312. Organic Chemistry (3, 3). Coverage of the important aliphatic, aromatic and heterocyclic compounds of carbon, with special emphasis on reaction mechanisms. Includes structure, nomenclature, isomerism, synthesis and reaction of organic compounds. Three lectures, one discussion period per week. (Prerequisite: Chemistry 104 or instructor's permission; Chemistry 311 prerequisite for 312.) Fall, spring.

313, 314. Organic Chemistry Laboratory (1, 1). Methods of compound preparation, separation and characterization, using instrumentation such as the gas chromatograph and infrared and nuclear magnetic resonance spectrometers. Chemistry 314 contains several weeks of qualitative organic

analysis. One 4-hour laboratory period per week. (Corequisites: Chemistry 311 for 313, 312 for 314.) Fall, spring.

321, 322. Physical Chemistry (3, 3). The theoretical study of chemical laws, theories and principles, including thermodynamics, chemical kinetics, quantum theory and molecular structure. Three lectures, one discussion period per week. (Prerequisite: Mathematics 205.) Fall, spring.

323, 324. Physical Chemistry Laboratory (1, 1). Laboratory study of chemical laws, theories and principles. One 5-hour laboratory period per week. (Prerequisite: Chemistry 302; Corequisites: Chemistry 321, 322.) Fall, spring.

333. Biochemistry (3). The chemistry and the biological significance of proteins, enzymes, lipids, nucleic acids and porphyrins, including the generation of phosphate bond energy via metabolism and its use in biosynthesis. Three lectures, one discussion period per week. (Prerequisites: Chemistry 311 and instructor's permission or Chemistry 312.) Spring.

334. Biochemistry Laboratory (1). Lab techniques for the study of macromolecules. (Corequisite: Biology 333 or Chemistry 333). Offered as needed.

401. Senior Seminar (1). Continuing on the skills learned in CHEM 301, students will continue research in a narrow focus and present the material in an oral presentation like one that would be found in a professional conference setting. (Prerequisites: Chemistry 301). Spring.

402. Instrumental Analysis (4). The theory and application of modern instrumental analysis techniques, including ultraviolet and visible spectrophotometry, emission, atomic absorption, infrared and nuclear magnetic resonance spectroscopy, gas chromatography and electrochemical methods. Three lectures, one 5-hour laboratory period per week. (Prerequisite: Chemistry 302; Corequisite: Chemistry 324 or instructor's permission.) Spring.

404. Advanced Inorganic Chemistry (3). Chemical theories and laws and their applications to inorganic systems, including quantum theory, wave mechanics, the periodic table, chemical bonding, inorganic stereochemistry, coordination compounds, acids and bases, non-aqueous solvents and the chemistry of selected elements. Three lectures per week. (Corequisite: Chemistry 321 or instructor's permission.) Spring.

405. Advanced Physical Chemistry (3). Quantum mechanics and statistical thermodynamics with applications to chemical systems. Three lectures per week. (Prerequisites: Chemistry 322, Math 215 and Math 303.). Offered as needed.

406. Advanced Organic Chemistry (3). Advanced theories of molecular structure and reactivity of organic compounds with attention to reaction mechanisms and the methods by which information is obtained about molecules and reactions. Three lectures per week. (Prerequisites: Chemistry 312 and 321 or instructor's permission.) Offered as needed.

410. Current Topics (1-3). Recent developments in the field of chemistry. May be repeated. (Prerequisite: instructor's permission.) Offered as needed.

Special and Advanced Courses

199. Exploratory Internship (1-3).

299. Experimental Course (1-3).

399. Professional Internship (1-12).

450. Research in Chemistry (1-3). Laboratory research on a topic agreed upon by the student and the faculty research director. A formal report of results is required. May be repeated for a maximum of 6 hours. (Prerequisite: department chairperson's permission.)

451. Independent Study (1-3). A program of independent research. May be repeated for a maximum of 6 hours. (Prerequisite: departmental chairperson's permission.)

499. Advanced Experimental Course (1-3).

Communication Arts and Sciences

The Department of Communication Arts and Sciences offers emphases in 1) argumentation and advocacy, 2) mass mediated communication and 3) communication teacher education. The department seeks to develop the student's knowledge, spirit of inquiry and creative skills in the art of communication and to broaden and deepen the understanding of communication as it operates in a free society. A major in Communication Arts and Sciences provides strong preparation for graduate school and for careers in public relations, radio, television, law, lobbying, and related fields.

Students seeking a Bachelor of Arts degree with a major in Communication Arts and Sciences must complete a minimum of 33 semester hours in the department.

Communication 102 does not count in the 46-hour maximum limits on departments.

All Communication majors must complete the following Communication Core (12 hours)

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|-------------------|----------------------------------|
| Communication 109 | Radio Studies (3) |
| Communication 110 | Survey of Mass Communication (3) |
| Communication 280 | Communication Ethics (3) |
| Communication 421 | Senior Project (3) |

Major Program Requirements

Bachelor of Arts in Communication Arts and Sciences with emphasis in Argumentation and Advocacy
(33 hours)

Communication Arts and Sciences Core (12 hours - see listing above)

Argumentation and Advocacy Core (15 hours)

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| COMM 205 | Public Relations I (3) |
| COMM 218 | Introduction to Communication Theory (3) |
| COMM 300 | Argumentation and Debate (3) |
| COMM 308 | Mass Communication Criticism (3) |
| COMM 403 | History of Communication (3) |