

CHEMISTRY (CHE)**416****214 Julian Hall, (309) 438-7661****Website: Chemistry.IllinoisState.edu****Chairperson:** Craig C. McLauchlan.**Tenured/Tenure-track Faculty:***Distinguished Professor:* Lash.*Professors:* Baur, Ferrence, Friesen, Hitchcock, Hunter, Jones, McLauchlan, Nagorski, Peters, Standard, Szczepura.*Associate Professors:* Hamaker, Kim, Mitchell, Mulligan.*Assistant Professors:* Boesdorfer, Driskell, McBride, Sullivan, Weitzel.**General Department Information**

The Department of Chemistry is on the approved list of the American Chemical Society. Contact the department for specific certification requirements.

HONORS IN CHEMISTRY

Students majoring in Chemistry may be admitted to the Departmental Honors Program if they have (1) prior admission to the University Honors Program, (2) completed at least 30 hours of college-level courses, including at least 2 courses in Chemistry, (3) a cumulative GPA of 3.30, and (4) applied for admission to departmental honors to the Chemistry chairperson or honors advisor and received approval for admission into the program.

In order to graduate with honors in Chemistry, a student must complete (1) all regular requirements for the Major in Chemistry including PHY 110 and 111, (2) 5 hours of CHE 290 and/or 299, of which at least 3 hours are CHE 299, (3) a research presentation at a university, regional, or national/international conference or symposium; (4) a minimum of four of the following courses: CHE 301, 315, 318, 344, 350, 362, 380; (5) IT 165, 168; MAT 147, 175, or 3 hours in non-Chemistry SMT courses numbered 200 or higher. Students in the Chemistry Teacher Education Sequence may substitute a capstone experience in chemical education for two of the credit hours of CHE 290/299 with the approval of the department. In addition, a student must have at the time of graduation a cumulative GPA of at least 3.30 and at least 3.50 in Chemistry courses, fulfill the general requirements for participation in the University Honors Program, be in the University Honors Program for at least three semesters, and be in good standing in the University Honors Program at the time of graduation. Further details about the University Honors program are available at: Honors.IllinoisState.edu.

Chemistry Programs

Degrees Offered: B.S.

MAJOR IN CHEMISTRY

- 45 hours required in Chemistry, including at least 37 hours in courses numbered 200 or higher.
- 32 hours of required core courses: CHE 140, 141, 215,

216, 230, 231, 232, 233, 250, 251, 342, 360, 361.

- 9 hours in advanced courses required, selected from the following: CHE 315, 344, 350, 362.
- 4 advanced laboratory courses required: CHE 316, 343, 351, 363. One hour of undergraduate research (CHE 290 or 299) or coop/internship (CHE 398A01 or 398A50) may substitute for one of these courses.
- 1 year of physics, preferably PHY 110 and 111, and 1 year of calculus (through MAT 146) must be completed prior to enrolling in CHE 360.
- Chemistry electives: The department strongly recommends that students take at least 6 hours of advanced electives in chemistry. Advising options for various career objectives are available from the department office and on the department website.
- A course in the major may not be taken more than twice unless the course description states "Multiple enrollments are allowed." An exception may be requested once during a student's undergraduate career if the GPA in the major plan and the overall GPA is 2.00 or higher.
- A grade of C or better is required in all the following Chemistry courses: CHE 140, 141, 215, 216, 230, 231, 232, 250, 251, 342, 360, 361.
- Students completing this degree program with a grade of C or better in all required Chemistry courses will earn an American Chemical Society Certified Degree.

Chemistry Teacher Education Sequence:

- 49 hours required in Chemistry, including at least 39 hours in courses numbered 200 or higher. A Teacher Education student must complete the option described as part of the entitlement program leading to endorsement: secondary 6-12.
- 32 hours of core Chemistry courses required: CHE 140, 141, 215, 216, 230, 231, 232, 233, 250, 251, 342, 360, 361.
- 9 hours of Chemistry teacher education courses required: CHE 161, 301 (3 hours), 302.
- 6 hours of advanced courses required, selected from the following: CHE 315, 344, 350, 362.
- 2 advanced laboratory courses required, selected from the following: CHE 316, 343, 351, 363. One hour of undergraduate research (CHE 290 or 299) may substitute for one of these courses.
- 1 year of physics, preferably PHY 110 and 111, and 1 year of calculus (through MAT 146) must be completed prior to enrolling in CHE 360.
- Professional Education requirements (25 hours): EAF 228 or 231 or 235; PSY 110, 215; TCH 212, 216, 219; STT 399A73 (8 hours). NOTE: PSY 110 is a prerequisite for PSY 215.
- Science competency courses (11 hours): BSC 197; GEO 100; PHY 205; or equivalent.
- A course in the major may not be taken more than twice unless the course description states "Multiple enrollments are allowed." An exception may be requested once during a student's undergraduate career if the GPA in the major plan and overall GPA is 2.00 or higher.
- A grade of C or better is required in the following

Chemistry courses: CHE 140, 141, 215, 216, 230, 231, 232, 250, 251, 342, 360, 361.

- For teaching licensure, a grade of C or better is required in all endorsement areas (including calculus, physics, and science competency courses), Chemistry, and Professional Education courses.
- Students completing the Chemistry Teacher Education Sequence must have a 2.50 or higher GPA in Chemistry, a 2.50 or higher GPA in Professional Education courses, and a cumulative GPA of 2.50 or higher.
- The following course is strongly recommended: SED 101.
- Students successfully completing this sequence will earn an American Chemical Society Certified Degree.

Pedagogy Emphasis Sequence:

- 49 hours required in Chemistry, including at least 39 hours in courses numbered 200 or higher. The Pedagogy Emphasis sequence does not lead to licensure in the State of Illinois.
- 32 hours of core Chemistry courses required: CHE 140, 141, 215, 216, 230, 231, 232, 233, 250, 251, 342, 360, 361.
- 9 hours of Chemistry teacher education courses required: CHE 161, 301 (3 hours), 302.
- 6 hours of advanced courses required, selected from the following: CHE 315, 344, 350, 362.
- 2 advanced laboratory courses required, selected from the following: CHE 316, 343, 351, 363. One hour of undergraduate research (CHE 290 or 299) may substitute for one of these courses.
- 1 year of physics, preferably PHY 110 and 111, and 1 year of calculus (through MAT 146) must be completed prior to enrolling in CHE 360.
- Professional Education requirements (25 hours): EAF 228 or 231 or 235; PSY 110, 215; TCH 212, 216, 219; STT 399A73 (8 hours). NOTE: PSY 110 is a prerequisite for PSY 215.
- Science competency courses (11 hours): BSC 197; GEO 100; PHY 205; or equivalent.
- A course in the major may not be taken more than twice unless the course description states “Multiple enrollments are allowed.” An exception may be requested once during a student’s undergraduate career if the GPA in the major plan and overall GPA is 2.00 or higher.
- A grade of C or better is required in the following Chemistry courses: CHE 140, 141, 215, 216, 230, 231, 232, 250, 251, 342, 360, 361.
- A grade of C or better is required in all areas (including calculus, physics, and science competency courses), Chemistry, and Professional Education courses.
- Students completing the Chemistry Pedagogy Emphasis sequence must have a 2.50 or higher GPA in Chemistry, a 2.50 or higher GPA in Professional Education courses, and a cumulative GPA of 2.50 or higher.
- The following course is strongly recommended: SED 101.

MINOR IN CHEMISTRY

- 21 hours required in Chemistry, including at least 13 hours in courses numbered 200 or higher excluding

CHE 204.

- Required courses: CHE 140, 141; 215 and 216 or 250 and 251; 220 or 230 and 231.

CLINICAL EXPERIENCES IN TEACHER EDUCATION

A variety of clinical (pre-student teaching) experiences, as well as student teaching, are included in the teacher candidates professional preparation. Observations, small and large group instruction, tutoring, field experiences, and student teaching are included in the Clinical Experiences Program. The experiences offered prior to student teaching are integral parts of specific college courses. Clinical experiences are provided in off-campus professional development schools, local schools, campus laboratory schools, agencies and other approved non-school settings. The Cecilia J. Lauby Teacher Education Center monitors and documents all clinical experiences. Teacher candidates will show verification of a having completed clinical experiences commensurate with attaining local, state, and national standards. Teacher candidates must provide their own transportation to clinical experiences sites.

Candidates are required to provide documentation of meeting all State of Illinois, district, and university requirements in regard to criminal background checks BEFORE beginning any clinical experiences. Criminal background checks must remain current as of the last day of the clinical experience. Candidates should consult with clinical course faculty and the Cecilia J. Lauby Teacher Education Center well in advance of clinical experiences to determine specific requirements needed each semester.

The approximate number of clinical hours associated with each course offering can be found with the appropriate course description in this Undergraduate Catalog. The following legend relates to the type and kind of activity related to a specific course.

Clinical Experiences Legend

- Observation (including field trips)
- Tutoring one-on-one contact
- Non-instructional assisting
- Small group instruction
- Whole class instruction
- Work with clinic client(s)
- Graduate practicum
- Professional meeting

Biochemistry Program

Degree Offered: B.S.

MAJOR IN BIOCHEMISTRY

- 45 hours required in Chemistry, including at least 37 hours in courses numbered 200 or higher.
- Required Chemistry courses (41 hours): CHE 140, 141, 215, 216, 230, 231, 232, 233, 250, 251, 342, 343, 344, 360, 361, 372, 373.
- 3 hours in advanced Chemistry courses required,

- selected from the following: CHE 315, 350.
- 1 hour in advanced Chemistry laboratory courses required, selected from the following: CHE 316, 351; one hour of undergraduate research (CHE 290 or 299) or coop/internship (CHE 398A01 or 390A50) may substitute for one of these courses.
 - 14 hours required in Biological Sciences: BSC 196, 197, 203, 219.
 - 1 year of Physics, preferably PHY 110 and 111, and 1 year of Calculus (through MAT 146) must be completed prior to enrolling in CHE 360.
 - Biochemistry electives: The department strongly recommends that students take at least 6 hours of advanced electives. Advising options for various career objectives are available from the department office and on the department website.
 - A course in the major may not be taken more than twice unless the course description states "Multiple enrollments are allowed." An exception may be requested once during a student's undergraduate career if the GPA in the major plan and overall GPA is 2.00 or higher.
 - A grade of C or better is required in the following Chemistry courses: CHE 140, 141, 215, 216, 230, 231, 232, 250, 251, 342, 360, 361.
 - Students completing this degree program with a grade of C or better in all required Chemistry courses will earn an American Chemical Society Certified Degree.

Chemistry Courses

102 CHEMISTRY AND SOCIETY NS 3 sem. hrs.

Selected topics from chemistry and science in general, and illustration of relevance of chemistry and other sciences in today's world. Lectures, demonstrations, recitation, and lab. Lecture and lab. Open only to students with no college credit in chemistry. May not be taken under the P/NP option. Materials charge optional.

110/112 FUNDAMENTALS OF CHEMISTRY AND LABORATORY NSA 4/1 sem. hrs.

Introductory survey of fundamental concepts, laws, and theories of chemical science and their application to common chemical systems. Not for credit if had CHE 141. May not be taken under the P/NP option. Materials charge optional for CHE 112. Prerequisites: CHE 110 or concurrent registration required for CHE 112.

140 GENERAL CHEMISTRY I NSA 4 sem. hrs.

Introduction to stoichiometry, thermochemistry, atomic structure, molecular structure and bonding, chemical equilibrium and kinetics with applications to gases, solids, liquids, and solutions. First half of a 2-semester sequence. Lecture and lab. May not be taken under the P/NP option. Materials charge optional. Prerequisites: Designed primarily for students with high school credit in chemistry. Grade of C or better in MAT 119; or grade of C or better or concurrent registration in MAT 120 or 144 or 145; or consent of the Department of Chemistry.

141 GENERAL CHEMISTRY II 4 sem. hrs.

Continuation of CHE 140. Introduction to chemical equilibrium and kinetics with applications to gases, solids, liquids, and solutions; acid-base equilibria; electrochemistry; nuclear chemistry; and coordination compounds. Lecture and lab. Materials charge optional. Prerequisite: CHE 140; Grade of C or better in CHE 140 required for Chemistry and Biochemistry majors.

161 INTRODUCTION TO TEACHING SCIENCE SEMINAR 2 sem. hrs.

Introduction to the nature of scientific inquiry, and research-based skills in science teaching and learning. Also offered as BSC 161. Prerequisites: Grade of B or better in CHE 110, CHE 140 or equivalent. Teacher Education major only.

204 CHEMISTRY OF LIFE SMT 3 sem. hrs.

Application of chemical principles to the understanding of life processes and exploration of classes of molecules important in everyday life. Lectures, demonstrations and lab. Not for credit major or minor. Prerequisites: COM 110 and ENG 101 and MAT 113, 120, 130, or 145; CHE 102 or 1 year high school chemistry. BSC 101 or equivalent recommended.

215 ANALYTICAL CHEMISTRY 3 sem. hrs.

Introduction to analytical chemistry emphasizing quantitative measurements with classical, optical, chromatographic, mass spectrometric, and electrochemical techniques. Includes sampling and statistics. Formerly *FUNDAMENTALS OF ANALYTICAL CHEMISTRY*. Prerequisites: CHE 141 and 220 or 230; grade of C or better in CHE 141 and 230 is required for Chemistry and Biochemistry majors.

216 ANALYTICAL CHEMISTRY LABORATORY 1 sem. hr.

Laboratory practice of the principles treated in Analytical Chemistry. Materials charge optional. Prerequisite: CHE 215 or concurrent registration.

220 ELEMENTARY ORGANIC CHEMISTRY 5 sem. hrs.

One-semester survey of organic chemistry. Fundamental principles of structure and mechanisms of organic reactions. Lecture and lab. Not for credit if had CHE 230. For non-majors; recommended for Agriculture, Family and Consumer Sciences, Health Sciences, Nursing, and others. Materials charge optional. Prerequisite: CHE 112 or 141.

230 ORGANIC CHEMISTRY I 3 sem. hrs.

Introduction to chemistry of aliphatic and aromatic organic compounds. First half of a 2-semester sequence. Not for credit if had CHE 220. Prerequisite: CHE 141; grade of C or better in CHE 141 is required for Chemistry and Biochemistry majors. No credit will be granted in CHE 230 until credit is earned in CHE 231.

231 ORGANIC CHEMISTRY LABORATORY**1 sem. hr.**

Laboratory practice illustrating preparations and reactions typical of functional groups. First half of a 2-semester sequence. Materials charge optional. Prerequisites: CHE 141; grade of C or better in CHE 141 is required for Chemistry and Biochemistry majors. Concurrent registration in CHE 230. No credit will be granted in CHE 231 until credit is earned in CHE 230.

232 ORGANIC CHEMISTRY II**3 sem. hrs.**

Continuation of Chemistry 230, including synthetic and mechanistic features of organic reactions. Prerequisite: CHE 230; grade of C or better in CHE 230 required for Chemistry and Biochemistry majors.

233 ORGANIC CHEMISTRY LABORATORY II**2 sem. hrs.**

Laboratory practice in newer techniques and methods of organic chemistry. Materials charge optional. Prerequisites: CHE 231; Grade of C or better in CHE 231 required for Chemistry and Biochemistry majors. Concurrent registration in CHE 232.

242 BASIC BIOCHEMISTRY**3 sem. hrs.**

Introduction to the chemistry of carbohydrates, lipids, proteins, nucleic acids and enzymes. Brief treatment of vitamins and intermediary metabolism. Not for credit if had CHE 342. Prerequisite: One semester of organic chemistry.

250 FUNDAMENTALS OF INORGANIC CHEMISTRY**3 sem. hrs.**

Survey of modern inorganic chemistry including structure of inorganic compounds, coordination chemistry, nonaqueous solvents and selected descriptive chemistry. Formerly *DESCRIPTIVE INORGANIC CHEMISTRY*. Prerequisite: Grade of C or better in CHE 220 or C or better in CHE 230.

251 FUNDAMENTALS OF INORGANIC CHEMISTRY LABORATORY**1 sem. hr.**

Fundamental experiments in inorganic chemistry, including methods of characterizing inorganic compounds. Specific experiments and techniques will vary. Materials charge optional. Prerequisite: CHE 250 or concurrent registration.

290 RESEARCH IN CHEMISTRY**1-2 sem. hrs.**

CR/NC only. Multiple enrollments are allowed; maximum 6 hours; only 3 hours are applicable toward the minor. Prerequisites: 17 hours of Chemistry or consent of the Department of Chemistry; Department form must be completed prior to registration.

301 TEACHING OF CHEMISTRY**3 sem. hrs.**

Modern methods and curricula of high school chemistry. Includes Clinical Experiences: 35 hours. Prerequisites: 17 hours of Chemistry and completion of Teacher Education Gateway 1. Chemistry Teacher Education major only. Grade of C or better in TCH 216 or PSY 215 or concurrent registration.

302 STUDENT TEACHING AND PROFESSIONAL SEMINAR**4 sem. hrs.**

A weekly seminar in which students exchange information and share reflections during and after student teaching. Prerequisites: CHE 301 and STT 399A73 concurrent registration. Chemistry Teacher Education major only.

310 BIOCHEMISTRY/MOLECULAR BIOLOGY SEMINAR**1 sem. hr.**

Introduction to scientific literature searching and techniques of oral and written scientific communication, focusing on current topics in biochemistry/molecular biology. Prerequisites: BSC 197, BSC 203 or 219; CHE 215; 342.

315 INSTRUMENTAL ANALYSIS**3 sem. hrs.**

Modern instrumental methods of chemical analysis including electroanalytical, spectroscopic, chromatographic, mass spectrometric, surface analytical, and bioanalytical methods. Prerequisites: CHE 215 and 360. Grade of C or better in CHE 215 and 360 required for Chemistry and Biochemistry majors.

316 INSTRUMENTAL ANALYSIS LABORATORY**1 sem. hr.**

Laboratory practice of the principles treated in Instrumental Analysis. Materials charge optional. Prerequisites: CHE 216 and 315 or concurrent registration; grade of C or better in CHE 216 for Chemistry and Biochemistry majors.

318 METHODS OF COMPUTATIONAL SCIENCE**3 sem. hrs.**

Introduction of a wide variety of computational techniques and their application to problems in chemistry and physics. Also offered as PHY 318. Prerequisites: CHE 140; IT 165; PHY 109 or 111; CHE 360 or PHY 220 or concurrent registration or consent of the instructor.

342 GENERAL BIOCHEMISTRY I**3 sem. hrs.**

Survey of the structure-function relationships of proteins, carbohydrates, lipids and nucleic acids, dynamic equilibria, energetics, reaction kinetics/mechanisms and metabolism. Not for credit if had CHE 242. Not for credit in Master of Science in Chemistry. Prerequisite: Grade C or better in CHE 232 or 1 year of organic chemistry or consent of the instructor.

343 BIOCHEMISTRY LABORATORY**2 sem. hrs.**

Application of biochemical principles and methods discussed in Chemistry 342. Lecture and lab. Materials charge optional. Prerequisite: CHE 242 or 342 or concurrent registration.

344 GENERAL BIOCHEMISTRY II**3 sem. hrs.**

Survey of important aspects of intermediary metabolism, metabolic regulation, membrane transport and bioenergetics. Topics will include hormonal controls and immunological response. Prerequisite: Grade of B or better in CHE 242 or grade of C or better in CHE 342.

350 ADVANCED INORGANIC CHEMISTRY
3 sem. hrs.

Advanced inorganic chemistry including modern bonding theories, spectroscopy, structures and reactivity of coordination, main-group and transition-metal compounds; selected special topics. Formerly *INORGANIC CHEMISTRY*. Prerequisites: MAT 146; PHY 109 or 111; grade of C or better in CHE 232 and 250 required for Chemistry and Biochemistry majors.

351 ADVANCED INORGANIC CHEMISTRY LABORATORY
1 sem. hr.

Advanced experiences in modern synthesis and quantitative characterization of inorganic compounds and materials. Specific experiments and techniques will vary. Materials charge optional. Formerly *INORGANIC CHEMISTRY LABORATORY*. Prerequisite: CHE 251; CHE 350 or concurrent registration.

360 PHYSICAL CHEMISTRY I
3 sem. hrs.

Physical chemistry topics including descriptions of gases, liquids, solutions, thermochemistry, thermodynamics, chemical and phase equilibrium, kinetic theory, and chemical kinetics. Prerequisites: CHE 141; grade of C or better in CHE 141 is required for Chemistry and Biochemistry majors; PHY 109 or 111; 8 hours of CHE or PHY courses numbered 200 or higher; MAT 146.

361 PHYSICAL CHEMISTRY LABORATORY I
1 sem. hr.

Laboratory applications of principles treated in physical chemistry. Materials charge optional. Prerequisite: CHE 360 or concurrent registration.

362 PHYSICAL CHEMISTRY II
3 sem. hrs.

Continuation of CHE 360, including introduction to quantum theory, atomic and molecular applications of quantum mechanics, spectroscopy, and statistical thermodynamics. Prerequisite: CHE 360; grade of C or better in CHE 360 is required for Chemistry and Biochemistry majors.

363 PHYSICAL CHEMISTRY LABORATORY II
1 sem. hr.

Laboratory studies related to principles of physical chemistry with emphasis on quantum mechanics and spectroscopy. Materials charge optional. Prerequisites: CHE 361; 362, or concurrent registration. Grade of C or better in CHE 361 is required for Chemistry and Biochemistry majors.

372 PHYSICAL BIOCHEMISTRY
3 sem. hrs.

Exploration of biochemical systems through the use of thermodynamics, kinetics, and spectroscopy. Prerequisites: CHE 342 and 360 or consent of the instructor; grade of C or better in both CHE 342 and 360 is required for Biochemistry majors.

373 PHYSICAL BIOCHEMISTRY LABORATORY
1 sem. hr.

Introduction to experimental techniques in physical chemistry with emphasis on biochemical processes. Materials charge optional. Prerequisites: CHE 361; grade of C or better in CHE 361 is required for Biochemistry majors. CHE 372 or concurrent registration.

380 TOPICS IN CONTEMPORARY CHEMISTRY
1-3 sem. hrs.

New concepts and recent developments in the fields of organic, chemical education, inorganic, analytical, physical, and biochemistry. Multiple enrollments are allowed if content differs. Prerequisites: CHE 232. Certain topics may also require CHE 301, 342, 360 or 362. Grade of C or better in CHE 232 (and CHE 360 if prerequisite) is required for Chemistry and Biochemistry majors. Contact the Department to see which of the following topics are available.

380A11 STRUCTURAL DETERMINATION IN CHEMISTRY
3 sem. hrs.

An intermediary level course concerning the application of spectroscopic techniques to the structure determination of organic compounds. Prerequisite: CHE 232.

380A15 MAGNETIC RESONANCE
3 sem. hrs.

This course covers essential concepts and principles in Nuclear Magnetic Resonance (NMR) and Electron Paramagnetic Resonance (EPR) spectroscopies. In EPR, the similarities and differences to NMR will be looked at. Prerequisite: CHE 233. CHE 362 is recommended.

380A23 POLYMER CHEMISTRY
3 sem. hrs.

Principles and applications of current nanoscience and polymer chemistry. Prerequisite: CHE 360 or consent of the instructor.

380A37 COMPUTATION OF MOLECULAR PROPERTIES
3 sem. hrs.

This course provides an introduction to common techniques employed in computational chemistry. Emphasis is placed on molecular mechanics and molecular dynamics along with methods of molecular orbital theory. Prerequisite: CHE 360.

380A41 BIOLOGICAL CATALYSTS
3 sem. hrs.

This course focuses on the biological catalysts that make life possible. Students will evaluate thermodynamic and kinetic aspects, structure, biological function and regulation of enzymes. Prerequisite: CHE 342 or equivalent.

380A45 X-RAY DIFFRACTOMETRY
3 sem. hrs.

Advanced study in the area of X-ray Crystallography. Prerequisite: CHE 362 or concurrent registration.

380A52 HOMOGENOUS CATALYSIS
3 sem. hrs.

This course will introduce topics in homogenous catalysis. Students will have the basic knowledge to understand the reactions discussed throughout the semester, multiple bonds and carbon-carbon bond formation. Prerequisite: CHE 232 or equivalent.

380A54 CARBOHYDRATES
3 sem. hrs.

This course is an overview of the physical, chemical, and biochemical aspects of simple and complex carbohydrates. Prerequisite: CHE 342 or equivalent.

380A59 ATMOSPHERIC CHEMISTRY

3 sem. hrs.

Advanced study of atmospheric chemistry. Topics covered include basic atmospheric structure and physics, photochemical smog, ozone depletion and greenhouse gas production with an emphasis on recent discoveries in the field. Prerequisite: CHE 360 or consent of the instructor.

380A63 INDUSTRIAL CHEMISTRY

3 sem. hrs.

Advanced study of physical inorganic chemistry in applied settings. Topics covered include industrial cooling processes, industrial catalysis, manufacturing and purification processes in applied settings. Not for credit if an equivalent course has been taken. MCE/MSCE degree or non-degree seeking students.

398 PROFESSIONAL PRACTICE: CHEMISTRY

1-16 sem. hrs.

Practical experience by employment in an industrial or governmental laboratory. Multiple enrollments are allowed; maximum 16 hours; no more than 4 hours/semester may be used to meet graduation requirements. CR/NC only. May be 2 to 5 periods of 1 term each. Prerequisites: Grade of C or better in CHE 232 and 233 or equivalent. A minimum of 45 hours completed. 2.50 GPA.

**398A01 PROFESSIONAL PRACTICE:
INTERNSHIP IN CHEMISTRY**

1-16 sem. hrs.

Practical experience by employment in an industrial or governmental laboratory. Multiple enrollments are allowed; maximum 16 hours; no more than 4 hours/semester may be used to meet graduation requirements. CR/NC only. May be 2 to 5 periods of 1 term each. Prerequisites: Grade of C or better in CHE 232 and 233 or equivalent. A minimum of 45 hours completed. 2.50 GPA.

**398A50 PROFESSIONAL PRACTICE:
COOP IN CHEMISTRY**

1-16 sem. hrs.

Practical experience by employment in an industrial or governmental laboratory. Multiple enrollments are allowed; maximum 16 hours; no more than 4 hours/semester may be used to meet graduation requirements. CR/NC only. May be 2 to 5 periods of 1 term each. Prerequisites: Grade of C or better in CHE 232 and 233 or equivalent. A minimum of 45 hours completed. 2.50 GPA.