

# DEPARTMENT OF CHEMISTRY

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## Programs

### Undergraduate

#### Major

- Chemistry Major (<https://catalog.tulane.edu/science-engineering/chemistry/chemistry-major/>)

#### Minor

- Chemistry Minor (<https://catalog.tulane.edu/science-engineering/chemistry/chemistry-minor/>)

### Graduate

- Chemistry, PhD (<https://catalog.tulane.edu/science-engineering/chemistry/chemistry-phd/>)

## Courses

### Chemistry (CHEM)

#### CHEM 1000 Special Topics (3)

Maximum Hours: 99

#### CHEM 1010 Introduction to Chemical Purification (3)

We are all continually surrounded by chemicals, from drugs to fuel to food additives. Ensuring these materials are free of dangerous contaminants is essential for human health and development. This course will introduce students to the most important techniques for purifying chemicals. We will use what we have learned in the classroom to isolate a number of different molecules in the lab, from ethanol to inorganic materials of eye-catching color. Open to high school students only.

#### CHEM 1070 General Chemistry I (3)

An introduction to chemical principles. Stoichiometry, thermochemistry, states of matter, periodic relationships, atomic structure and bonding. Three hours of lecture per week. Concurrent registration in 1075 required.

Corequisite(s): CHEM 1075.

#### CHEM 1075 General Chemistry Lab I (1)

Laboratory to accompany 1070. Basic principles of chemical safety. Introduction to laboratory techniques in chemistry. Experiments dealing with stoichiometry, thermochemistry, properties of gases, and simple analytical techniques. One three hour lab per week. Concurrent registration in 1070 required.

Corequisite(s): CHEM 1070.

#### CHEM 1080 General Chemistry II (3)

The chemistry of solutions, equilibrium, thermodynamics, electrochemistry, kinetics. Three hours of lecture per week. Concurrent registration in 1085 required.

Prerequisite(s): CHEM 1070 and 1075.

Corequisite(s): CHEM 1085.

#### CHEM 1085 General Chemistry Lab II (1)

A continuation of 1075. Chemical safety in the workplace. Experiments to illustrate principles of chemical equilibrium, electrochemistry, kinetics, thermodynamics, qualitative and quantitative analysis. One three hour laboratory per week.

Prerequisite(s): CHEM 1070 and 1075.

Corequisite(s): CHEM 1080.

#### CHEM 1890 Service Learning (0-1)

Students complete a service activity in the community in conjunction with the content of a three-credit co-requisite course. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

**CHEM 1940 Transfer Coursework (0-20)**

Transfer Coursework at the 1000 level. Departmental approval may be required.

**Maximum Hours:** 99

**CHEM 1945 Transfer Credit (0-20)**

Transfer Coursework

**Maximum Hours:** 99

**CHEM 2310 Quantitative Analysis (3)**

Basic theory of gravimetric, volumetric and selected instrumental methods of analysis. Three hours of lecture per week. Offered by arrangement.

**Corequisite(s):** CHEM 2315.

**CHEM 2315 Quantitative Analysis Lab (1)**

Laboratory to accompany 2310. Practice of gravimetric, volumetric and selected instrumental methods of analysis. Two four hour laboratory periods per week. Offered by arrangement.

**Corequisite(s):** CHEM 2310.

**CHEM 2410 Organic Chemistry I (3)**

An introduction to organic reaction mechanism and organic spectroscopy. Three hours of lecture per week.

**Prerequisite(s):** CHEM 1080 and 1085.

**Corequisite(s):** CHEM 2415.

**CHEM 2415 Organic Chemistry Lab I (1)**

Laboratory to accompany 2410. Introduction to laboratory techniques in organic chemistry. Synthesis of organic compounds. One four-hour laboratory period per week.

**Prerequisite(s):** CHEM 1080 and 1085.

**Corequisite(s):** CHEM 2410.

**CHEM 2420 Organic Chemistry II (3)**

Laboratory to accompany 2420. A continuation of 2415. Includes identification of unknown organic compounds. One four-hour laboratory period per week.

**Prerequisite(s):** (CHEM 2410 and 2415) or (CHEM 2430 and 2435).

**Corequisite(s):** CHEM 2425.

**CHEM 2425 Organic Chemistry Lab II (1)**

Laboratory to accompany 2420. A continuation of 2415. Includes identification of unknown organic compounds. One four-hour laboratory period per week.

**Prerequisite(s):** (CHEM 2410 and 2415) or (CHEM 2430 and 2435).

**Corequisite(s):** CHEM 2420.

**CHEM 2430 Organic Chemistry I: Deep-learning (3)**

An advanced introduction to organic chemistry and organic reaction mechanisms. This small class is focused on group-learning, peer-instruction, and problem solving. Evaluations will be based on non-standard testing, e.g., open-book and/or (effectively) open-ended testing. Three hours of lecture per week.

**Prerequisite(s):** CHEM 1080 and 1085.

**Corequisite(s):** CHEM 2435.

**CHEM 2435 Organic Chemistry I Laboratory: Deep-learning (1)**

An advanced laboratory to accompany CHEM 2430. Introduction to laboratory techniques inorganic chemistry. Separation/purification, synthesis, and characterization of organic molecules. One four-hour laboratory period per week.

**Prerequisite(s):** CHEM 1080 and 1085.

**Corequisite(s):** CHEM 2430.

**CHEM 2440 Organic Chemistry II: Deep-learning (3)**

An advanced analysis of the major classes of molecules and reaction types, the spectroscopic analysis of organic molecules, and the major classes of bio(macro)molecules. This small class is focused on group-learning, peer-instruction, and problem solving. Evaluations will be based on non-standard testing, e.g., open-book and/or (effectively) open-ended testing.

**Prerequisite(s):** (CHEM 2410 and 2415) or (CHEM 2430 and 2435).

**Corequisite(s):** CHEM 2445.

**CHEM 2445 Organic Chemistry Laboratory II: Deep-learning (1)**

An advanced laboratory to accompany CHEM 2440 (and therefore limited to 30 students). A continuation of CHEM 2435. The laboratory continues to introduce organic synthesis techniques with a range of illustrative chemical syntheses combined with accompanying chromatographic, and Nuclear Magnetic Resonance (NMR) and Infrared (IR) Spectroscopic characterization of reaction components and products.

**Prerequisite(s):** (CHEM 2410 and 2415) or (CHEM 2430 and 2435).

**Corequisite(s):** CHEM 2440.

**CHEM 2480 Chemistry of Energy (3)**

Chemistry associated with natural as well as human caused energy changes. The course is designed for students with a serious interest in environmental issues.

**Prerequisite(s):** CHEM 1070.

**CHEM 2500 Environmental Chemistry (3)**

An overview of the many aspects of environmental chemistry. Topics include: aquatic chemistry, including water pollution and water treatment; atmospheric chemistry, air pollution and major threats to the global atmosphere; geochemistry and soil chemistry; nature, sources, and environmental chemistry of hazardous wastes; and toxicology chemistry.

**Prerequisite(s):** CHEM 1070 and 1080.

**CHEM 2890 Service Learning (0-1)**

Students complete a service activity in the community in conjunction with the content of a three-credit co-requisite course. Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 2940 Transfer Coursework (0-20)**

Transfer Coursework at the 2000 level. Department approval may be required.

**Maximum Hours:** 99

**CHEM 3110 Physical Chemistry I (3)**

Elementary quantum mechanics, quantum theory of molecular structure and bonding, fundamentals of spectroscopy. Three hours of lecture per week.

**Prerequisite(s):** CHEM 1080, 1085 and MATH 2240.

**Corequisite(s):** CHEM 3115.

**CHEM 3115 Physical Chemistry Lab I (1)**

Laboratory to accompany 3110. Experiments in spectroscopy and spectroscopic analysis. One four-hour laboratory period per week. Concurrent registration in 3110 required.

**Prerequisite(s):** CHEM 1080, 1085 and MATH 2240.

**Corequisite(s):** CHEM 3110.

**CHEM 3120 Physical Chemistry II (3)**

First, Second, and Third laws of thermodynamics, thermodynamic energy state functions, phases of pure substances, properties of mixtures, chemical equilibrium, equilibrium electrochemistry, statistical thermodynamics. Three hours of lecture per week.

**Prerequisite(s):** CHEM 1080, 1085 and MATH 2210.

**Corequisite(s):** CHEM 3125.

**CHEM 3125 Physical Chemistry Lab II (1)**

Laboratory to accompany CHEM 3120. Experiments illustrate thermodynamic and statistical mechanical principles. One four-hour laboratory period per week.

**Prerequisite(s):** CHEM 1080, 1085 and MATH 2210.

**Corequisite(s):** CHEM 3120.

**CHEM 3210 Inorganic Chemistry (3)**

Periodic relationships, types of bonding, coordination complexes, acid-base concepts, inorganic reaction mechanisms. Three hours of lecture per week. Concurrent registration in 3230 required. Prerequisite(s): CHEM 3110 and 3115. Corequisite(s): CHEM 3215.

**Prerequisite(s):** CHEM 3110 and 3115.

**Corequisite(s):** CHEM 3215.

**CHEM 3215 Inorganic Chemistry Lab (1)**

Laboratory to accompany 3210. Synthetic methods in inorganic and organometallic chemistry. Use of instrumental methods in organic chemistry. One four hour laboratory period per week.

**Prerequisite(s):** CHEM 3110 and 3115.

**Corequisite(s):** CHEM 3210.

**CHEM 3310 Instrumental Analysis (3)**

Introduction to modern methods of instrumental analysis including separation techniques and spectroscopic and electrochemical methods. Three hours of lecture per week. Concurrent registration in 3330 required. Offered in alternate years.

**Prerequisite(s):** (CHEM 2410 and 2415) or (CHEM 2430 and 2435).

**CHEM 3315 Instrumental Analysis Lab (1)**

Laboratory to accompany 3310. Practice of separation techniques and spectroscopic and electrochemical methods of analysis. Two four-hour laboratory periods per week. Concurrent registration in 3310 required. Offered in alternate years.

**Prerequisite(s):** (CHEM 2410 and 2415) or (CHEM 2430 and 2435).

**Corequisite(s):** CHEM 3310.

**CHEM 3410 Macromolecular, Supramolecular, and Nanochemistry (3)**

An advanced courses for those interested in chemistry of nanomaterials and polymers. This should be beyond the two courses of general chemistry and the two courses of organic chemistry. Evaluations will be based on quizzes, tests, plus the final exam. The class will be schedule three hours per week.

**Prerequisite(s):** (CHEM 2420 and 2425) or (CHEM 2440 and 2445).

**CHEM 3510 Python Programming for Chemistry (3)**

Introduction to basic Python programming skills with applications in Chemistry.

**Prerequisite(s):** CHEM 1070 and 1080.

**CHEM 3660 Special Topics (1-3)**

Special topics in Chemistry. Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 3665 Special Topics Lab (1-3)**

Courses offered by visiting professors or permanent faculty primarily for undergraduates. For description, consult department. Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 3830 Intro To Biochemistry (3)**

Properties of biological compounds. Bioenergetics, basic metabolic pathways, general biochemical mechanisms. Offered jointly with the cell and molecular biology department.

**Prerequisite(s):** CHEM 2420 or 2440.

**CHEM 3835 Intro to Biochem Lab (2)**

Eight hours of laboratory per week. Offered in the Fall semester.

**CHEM 3840 Intermediate Biochem (3)**

Intermediary metabolism with emphasis on the integration of lipid, saccharide, and amino acid metabolism. Electron transport and oxidative phosphorylation. Photosynthesis. Purine and pyrimidine metabolism. Offered jointly with the cell and molecular biology department.

**Prerequisite(s):** CHEM 3830.

**CHEM 3890 Service Learning (0-1)**

Students complete a service activity in the community in conjunction with the content of a three-credit co-requisite course. Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 3915 Special Topics in Chemistry (1-3)****CHEM 3940 Transfer Coursework (0-20)**

Transfer Coursework at the 3000 level. Department approval may be required.

**Maximum Hours:** 99

**CHEM 4010 Research (1-3)**

Individual research supervised by the faculty. Students are expected to present a short seminar based on their research. At least 10 hours of research effort per week. Course may be repeated up to 3 credit hours.

**Maximum Hours:** 3

**CHEM 4020 Research and Seminar (1-3)**

Individual research supervised by the faculty. Students are expected to present a short seminar based on their research. At least 10 hours of research effort per week. A maximum of three credits may be taken.

**Maximum Hours:** 3

**CHEM 4030 Research (1-3)**

Individual research supervised by the faculty. Students are expected to present a short seminar based on their research. At least 10 hours of research effort per week. A maximum of three credits may be taken.

**Maximum Hours:** 3

**CHEM 4080 Computational Neurochemistry (3)**

Introduction to 3D computational modeling of electrochemical signaling, including laws of diffusion, electrochemistry, resting and action potentials, synaptic communication between neurons, and synaptic plasticity.

**Prerequisite(s):** CHEM 1080 and (CELL 3310 or NSCI 3310).

**CHEM 4660 Special Topics (1-3)**

Courses offered by visiting professors or permanent faculty primarily for undergraduates. For description, consult department. Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 4890 Service Learning (0-1)**

Students complete a service activity in the community in conjunction with the content of a three-credit co-requisite course. Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 4910 Independent Study (1-4)**

Laboratory or library research under direction of a faculty member.

**CHEM 4920 Independent Study (1-3)****CHEM 4940 Transfer Coursework (0-20)**

Transfer coursework at the 4000 level. Departmental approval required.

**Maximum Hours:** 99

**CHEM 4990 Honors Thesis (3)**

Honors thesis research, first semester. Register in department.

**CHEM 5000 Honors Thesis (4)**

For especially qualified seniors with approval of the faculty director and the Office of Academic Enrichment. Students must have a minimum of a 3.400 overall grade-point average and a 3.500 grade-point average in the major.

**Prerequisite(s):** CHEM 4990.

**CHEM 5380 Study Abroad (1-20)**

Courses taught abroad by non-Tulane faculty. Does not count toward Tulane GPA. Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 5390 Study Abroad (1-20)**

Courses taught abroad by non-Tulane faculty. Does not count toward Tulane GPA. Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 6080 Computational Neurochemistry (3)**

Introduction to 3D computational modeling of electrochemical signaling, including laws of diffusion, electrochemistry, resting and action potentials, synaptic communication between neurons, and synaptic plasticity.

**Prerequisite(s):** NSCI 6310 or CELL 6310.

**CHEM 6150 Interm Physical Chem I (3)**

Elementary quantum mechanics, quantum theory of molecular structure and bonding, fundamentals of spectroscopy.

**CHEM 6160 Interm Physical Chemistry II (3)**

First, Second, and Third Laws of thermodynamics, thermodynamic energy state functions, phases of pure substances, properties of mixtures, chemical equilibrium, equilibrium electrochemistry, statistical thermodynamics.

**CHEM 6250 Intermediate Inorganic (3)**

Periodic relationships, types of bonding, coordination complexes, acid-base concepts, inorganic reaction mechanisms.

**CHEM 6460 Intermediate Organic (3)**

Structural, chemical, and physical properties of organic compounds.

**CHEM 6510 Python Programming for Chemistry (3)**

Introduction to basic Python programming skills with applications in Chemistry

**Prerequisite(s):** CHEM 1070 and 1080.

**CHEM 6660 Special Topics (1-3)**

Courses offered by visiting professors or permanent faculty primarily for undergraduates. For description, consult department. Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 6830 Intro To Biochemistry (3)**

Properties of biological compounds, Bioenergetics, basic metabolic pathways, general biochemistry mechanisms.

**CHEM 6840 Intermediate Biochemistry (3)**

Intermediary metabolism with emphasis on the integration of lipid, saccharide, and amino acid metabolism. Electron transport and oxidative phosphorylation.

**CHEM 6940 Transfer Coursework (0-20)**

Transfer coursework at the 6000 level. Departmental approval required.

**Maximum Hours:** 99

**CHEM 7010 Independent Study (1-3)**

This is a directed study course that allows a graduate student to pursue a topic of particular interest under the direction of a faculty member.

**CHEM 7020 Independent Study (1-3)****CHEM 7110 Intro to Quantum Mechanics (3)**

The classical wave equation; the Schrödinger equation; principles of quantum mechanics; harmonic oscillator; rigid rotor; hydrogen atom; approximate methods: perturbation theory, variational principle.

**CHEM 7120 Statistical Mechanics (3)**

Review of the principles of thermodynamics; canonical and other ensembles; Bose-Einstein, Fermi-Dirac, and Boltzmann statistics; non-interacting system; Monte Carlo methods; phase transitions, classical fluids; non-equilibrium systems.

**CHEM 7130 Advanced Quantum Chemistry (3)**

Advanced topics in quantum chemistry and dynamics.

**CHEM 7140 Computational Quantum Chemistry (3)**

This introductory course in computational quantum chemistry will discuss selected topics of molecular modelling with an emphasis on quantum mechanical methods. The scope of this course incorporates ab initio methods, density functional theory, molecular mechanics, and semiempirical approaches. This course is set up for graduate-level requirements, but should be accessible to advanced undergraduates. Graduate-level quantum mechanics is not required, but a good undergraduate-level quantum chemistry background is expected.

**CHEM 7150 Chemical Physics (3)**

Classical and quantum theory of radiation.

**CHEM 7190 Selected Topics Physical Chemi (3)**

Selected topics in experimental and/or theoretical physical chemistry. Can be repeated up to unlimited credit hours.

**Maximum Hours: 99****CHEM 7210 Inorganic Stru & Bond (3)**

Descriptions of bonding theories as applied to inorganic systems. The course covers symmetry and group theory, crystal field theory, and generalized aspects of molecular orbital theory. Three hours of lecture per week.

**CHEM 7220 Inorganic Reaction Mechanics (3)**

The course discusses the primary reactions of transition metal, organometallic and main group compounds. Concepts of chemical kinetics are applied to inorganic substitution, isomerization, oxidation/reduction, catalysis and photochemistry. The theoretical framework associated with electron and atom transfer reactions is also presented.

**CHEM 7230 Organomet/Trans. Metals (3)**

The chemistry of compounds containing transition metal-carbon bonds. A survey of major classes of organotransition metal compounds, their bonding, and their reaction chemistry. The role of transition metal organometallic compounds in homogeneous catalysis. Three hours of lecture per week.

**CHEM 7240 Organometallic Chemistry (Main Group Metals) (3)**

The chemistry of compounds containing main group metal-carbon bonds. A survey of major classes of organometallic compounds, their bonding, and their reaction chemistry. The role of main group organometallic compounds in organic synthesis and polymer chemistry. Three hours of lecture per week.

**CHEM 7250 Phys Meth Inorganic Chem (3)**

This course is a problem solving based course focusing on characterization of inorganic substances using methods common to Inorganic Chemistry including multinuclear NMR, ESR, Mass Spectrometry, IR, electrochemical methods, magnetic methods and other more specialized techniques.

**CHEM 7260 Crystallography (3)**

Basic principles of single crystal x-ray diffraction and their applications to the determination of the structures of small molecules. Each student will collect x-ray data on a crystal and determine the structure of the molecule.

**CHEM 7270 Photochemistry (3)**

Photophysical processes, experimental methods, photochemistry of transition metal complexes, photosynthesis, solar photochemistry, photoinduced energy and electron transfer processes, photochromism.

**CHEM 7280 Inorganic Nanochemsity (3)**

The course will explore a variety of systems 0D (nanoparticles), 1D (nanotubes, nanoribbons), and 2D (nanosheets) using a number of illustrative examples, including gold and silica nanoparticles, silicon nanotubes, fullerenes, and graphenes. Emphasis will be placed on synthetic methods, characterization techniques, and applications.

**CHEM 7290 Selected Topics Inorg Chem (3)**

The chemistry of metals in biology. An overview of the important metalloenzyme systems and other metallobiomolecules, such as O<sub>2</sub> transport proteins. The course also covers inorganic pharmaceuticals and metal-based imaging agents in medicine. Three hours of lecture per week. Can be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 7390 Selected Topics Biolog Chem (3)**

Biochemical and biophysical methods, mechanisms of enzyme catalysis, membrane structure and function, metabolic regulation, physical biochemistry, protein folding related topics. Can be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 7410 Adv Organic Physical Organic (3)**

This course focuses on the fundamentals of Organic Chemistry, including molecular orbital theory, thermochemistry/strain/stability, stereochemistry, acid/base chemistry, reactivity, kinetics, and catalysis. The course is designed to provide the theoretical foundation behind experimental synthetic chemistry.

**CHEM 7420 Adv Organic Spectroscopy (3)**

This course covers the elementary theory and slightly more advanced interpretation of common instrumental methods employed by organic chemists. These include NMR spectroscopy (including some 2D, multinuclear, and dynamic NMR), mass spectrometry, X-ray crystallography, IR, UV, and EPR spectroscopy, and various chiroptical methods.

**CHEM 7430 Adv Organic Chem Natural Prod (3)**

Structural determination, synthesis, and biosynthesis of both classical and modern natural product target molecules. Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 7440 Adv Organic Polymer Chemistry (3)**

This course establishes a basic fundamental background for polymer chemists, including the major synthetic techniques for preparing polymers, the strengths and weakness of various techniques for determining molecular weight and structure, as well as correlation between polymer molecular structure and the resultant physical properties (and therefore useful applications).

**CHEM 7450 Adv Organic Supramolecular Che (3)**

This course focuses on a variety of aspects of supramolecular chemistry. It includes the fundamental physical chemistry important to the field and a review of the current state-of-the-art. The course also includes hands-on experience with analyzing supramolecular systems using spectroscopic and/or calorimetric approaches.

**CHEM 7460 Adv Organic-Synthetic Ap (3)**

Design of syntheses for complex organic molecules. The strategies involved for constructing molecules with complex stereo and regio chemistry, while addressing issues of efficiency and yield.

**CHEM 7470 Adv Organic Chem Nucleic Acids (3)**

This course provides a background to understanding the structure of nucleic acids and the forces involved in their binding and recognition. A particular focus involves the how to design sequences that enable binding, including topics such as using aptamers for selective binding and recognition.

**CHEM 7480 Medicinal Chemistry (3)**

Medicinal chemistry deals with the method of developing new drugs. This class will discuss the drug development process, techniques that are used to develop new drugs (e.g., screening, computer modelling), and the mode of action of existing drugs. The prerequisites are successful completion of an organic chemistry course (e.g., CHEM 2410) and a biochemistry course (e.g., CHEM 3830).

**CHEM 7490 Selected Topics Org Chem I (3)**

This is a survey course covering key topics in contemporary organic chemistry. The focus is on growing and far-reaching issues that are central to all forms of organic chemistry research.



**CHEM 7491 Selected Topics Org Chem II (3)**

This is an in-depth course covering a key, topic of contemporary organic chemistry. The focus is on growing and far-reaching issues that are central to organic chemistry research in an academic or industrial setting. Can be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 7660 Special Topics (0-4)**

Special Topics. Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 7870 Division Seminar (1)**

Weekly seminars by visiting faculty and students. Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 7880 Division Seminar (1)**

Weekly seminars by visiting faculty and students. Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 7890 Techniques of Research (1-9)**

Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 7900 Techniques of Research (1-9)**

Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 7940 Transfer Credit-Grad (1-12)**

Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 9980 Masters Research (3)**

Research toward completion of a masters degree. Course may be repeated up to unlimited credit hours.

**Maximum Hours:** 99

**CHEM 9990 Dissertation Research (0-3)**

Research toward completion of a doctoral degree.

**Maximum Hours:** 99