

# CHE - CHEMISTRY

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## **CHE 110 General Chemistry I (4 Credit Hours)**

The first course of a two-semester course experience that provides the general study of chemical concepts and principles. Topics include: matter and energy, reaction stoichiometry and the mole concept, periodic properties of the elements, atomic and molecular structure, thermochemistry, chemical bonding, and chemical reactions. This course is accompanied by a co-requisite laboratory, CHE 110L.

May be repeated for credit.

**Academic Level:** Undergraduate

**Corequisites:** CHE 110L

## **CHE 110L General Chemistry I Lab**

Chemistry 110L is the co-requisite laboratory experience that accompanies General Chemistry I (CHE 110), during which basic laboratory skills and techniques will be developed. Students will also gain first-hand experience with chemical reactions connected to major chemical concepts and processes that are studied.

**Academic Level:** Undergraduate

**Corequisites:** CHE 110

## **CHE 111 General Chemistry II (4 Credit Hours)**

The second course of a two-semester course experience that continues from CHE 110. Topics include: thermodynamics, reaction kinetics, equilibrium and acid-base chemistry, redox reactions and electrochemistry, the properties of gases and condensed phases, and selected additional topics. This course is accompanied by a co-requisite laboratory, CHE 111L.

May be repeated for credit.

**Academic Level:** Undergraduate

**Corequisites:** CHE 111L

## **CHE 111L General Chemistry II Lab**

Chemistry 111L is the co-requisite laboratory experience that accompanies General Chemistry II (CHE 111), during which laboratory skills and techniques will be further developed. Students will also gain first-hand experience with chemical reactions connected to major chemical concepts and processes that are studied.

**Academic Level:** Undergraduate

**Corequisites:** CHE 111

## **CHE 115 Chemistry of Nature (4 Credit Hours)**

Chemistry of Nature (CHE 115) is a synergistic course connecting the fundamentals of chemistry to the everchanging realm of environmental science. Students will be instructed through an applied lens where we will use the natural laboratory of Earth to see how chemical phenomena have formed and continue to alter processes in terrestrial, aquatic, atmospheric, and polar environments. The core principles of chemistry that will be emphasized include: atomic/molecular structure, chemical reactions/transformations, inter- and intramolecular forces, buffers and acid/base neutralization, reduction-oxidation reactions, and thermochemistry. This course will implement argument driven inquiry-based learning where real-world biogeochemical dilemmas are the focus. Students will first explore terrestrial, aquatic, atmospheric, and polar environments as dynamic chemical systems before being challenged to diagnose environmental crises and design action plans to combat these crises. Additionally, students will be required to formally communicate their thoughts and findings in both oral, written, and digital formats.

**Academic Level:** Undergraduate

**Corequisites:** CHE 115L

## **CHE 115L Chemistry of Nature Lab**

Chemistry of Nature Lab (CHE 115L) is the laboratory component that accompanies Chemistry of Nature Lecture (CHE 115). Students will utilize the natural laboratory of Maine & the University of New England campus to gain a hands-on experiential education of how aquatic, terrestrial, and atmospheric environments are dynamic chemical systems. Fieldwork will be a vital component of this course where students will be able to utilize University resources to complete sampling of Maine coastlines. This laboratory science course will also incorporate science communication through the use of argument development and creative environmental planning to better prepare students for future careers.

**Academic Level:** Undergraduate

**Corequisites:** CHE 115

## **CHE 130 Principles of Chemistry (4 Credit Hours)**

Principles of Chemistry is a one semester introduction to the basic principles of general, organic, and biological chemistry that is accompanied by a co-requisite laboratory experience. Designed primarily for students in allied health programs, the course connects chemical principles to their physical manifestations and biological applications. Emphasis is on the integration, application and understanding of foundational chemical concepts to assist students in connecting science to society and to health-related professions.

**Academic Level:** Undergraduate

**Corequisites:** CHE 130L

## **CHE 130L Principles of Chemistry Lab**

CHE 130L is the co-requisite lab that accompanies the Principles of Chemistry course. The three-hour weekly laboratory session emphasizes problem solving with hands-on inquiry to foster the application and understanding of key chemical concepts.

May be repeated for credit.

**Academic Level:** Undergraduate

**Corequisites:** CHE 130

## **CHE 150 University General Chemistry I (4 Credit Hours)**

The first course of a two-semester course experience providing an in-depth introduction to the principles of chemistry. Topics include: matter and energy, reaction stoichiometry and the mole concept, periodic properties of the elements, atomic and molecular structure, thermochemistry, chemical bonding, chemical reactions, and includes opportunities for exploration of individualized topics. This course is designed for students interested in the natural and health sciences and provides a strong foundation in scientific principles. With associated, inquiry-based laboratory that includes an emphasis on experiment design and analysis as well as learning through scientific writing.

**Academic Level:** Undergraduate

**Corequisites:** CHE 150L

## **CHE 150L University General Chemistry I Lab**

CHE 150L is the co-requisite laboratory experience that accompanies CHE 150, during which basic laboratory skills and techniques will be introduced along with inquiry-based laboratory activities, experimental design, and scientific writing.

**Academic Level:** Undergraduate

**Corequisites:** CHE 150

**CHE 151 University General Chemistry II (4 Credit Hours)**

A continuation of CHE 150. Topics include: the properties of gases and condensed phases, reaction kinetics, thermodynamics, equilibrium and acid-base chemistry, redox reactions and electrochemistry, and selected topics in descriptive, organic, and nuclear chemistry. This course is designed for students interested in the natural and health sciences and provides a strong foundation in scientific principles. With associated, inquiry-based laboratory that includes an emphasis on experiment design and analysis as well as learning through scientific writing.

**Academic Level:** Undergraduate

**Corequisites:** CHE 151L

**CHE 151L University General Chemistry II Lab**

CHE 151L is the co-requisite laboratory experience that accompanies CHE 151, during which laboratory skills and techniques will be further developed along with inquiry-based laboratory activities, experimental design, and scientific writing.

**Academic Level:** Undergraduate

**Corequisites:** CHE 151

**CHE 201 Organic Chemistry I (4 Credit Hours)**

The Organic Chemistry I course, including class and corequisite laboratory, is the first semester of a two-semester sequence of introductory undergraduate organic chemistry for science majors. In the class component of Organic Chemistry I, the structure, function, behavior, and reactivity theories of carbon-containing molecules are studied in view of acid-base and organic substitution and elimination reactions and their mechanisms. The two- and three- dimensional representation of organic molecules is explored, including concepts of functional groups, conformation, conjugation, resonance, and stereochemistry. Intermolecular forces that govern the physical properties of organic molecules and chemical reactivity are investigated. The corequisite Organic Chemistry I laboratory focuses on mastery of laboratory skills using Organic Chemistry I principles, theories, and concepts, including use of key instrumentation.

**Academic Level:** Undergraduate

**Corequisites:** CHE 201L

**CHE 201L Organic Chemistry I Lab**

The corequisite Organic Chemistry I laboratory focuses on the mastery of microscale techniques and experimental procedures used for organic synthesis, compound purification, and structural characterization. Students use instrumentation such as digital melting point devices, a polarimeter, infrared spectrometers, UV-Visible spectrometers, a gas chromatograph–mass spectrometer, and/or a nuclear magnetic resonance spectrometer, and analyze data to elucidate organic structure and/or determine reaction outcomes from experimentation. Competency in executing and interpreting chromatography is also gained.

**Academic Level:** Undergraduate

**Corequisites:** CHE 201

**CHE 202 Organic Chemistry II (4 Credit Hours)**

The Organic Chemistry II course, including class and corequisite laboratory, is the second semester of a two-semester sequence of introductory undergraduate organic chemistry for science majors. In the class component of organic chemistry II, multistep mechanisms will be studied to understand how molecular structure enables the reactions between molecules. Synthetic schemes will be constructed using knowledge of chemical reactions and the products from those reactions. The following reaction classes will be studied in Organic Chemistry II: addition reactions, oxidation-reduction reactions, condensation reactions, cycloaddition reactions, radical reactions, and net substitution reactions at non-sp<sup>3</sup> centers. The corequisite organic chemistry II laboratory focuses on mastery of laboratory skills using organic chemistry II principles, theories, and concepts, including use of key instrumentation.

**Academic Level:** Undergraduate

**Corequisites:** CHE 202L

**CHE 202L Organic Chemistry II Lab**

The corequisite Organic Chemistry II laboratory builds upon the basic lab skills, techniques, and methods of analysis learned in the first semester of organic chemistry laboratory. In Organic Chemistry II lab, students set up and complete organic chemistry reactions as single or multi-step experiments. Reaction monitoring and processing, including product separation, purification, isolation, analysis, and lab decision-making will be stressed. Students will also use key instrumentation to analyze their experimental outcomes as appropriate such as a gas chromatograph–mass spectrometer, nuclear magnetic resonance spectrometer, infrared spectrometer, polarimeter, and/or UV-Visible spectrometer.

**Academic Level:** Undergraduate

**Corequisites:** CHE 202

**CHE 250 University Organic Chemistry I (5 Credit Hours)**

University Organic Chemistry I (CHE 250) is the first semester of a comprehensive one-year course suitable for science majors that has an accompanying corequisite laboratory and laboratory lecture. The course focuses on the structural and functional aspects of saturated and unsaturated hydrocarbons containing various heteroatom functionalities. Specific topics include functional groups, conformation, stereochemistry, physical property trends, aromaticity, and substitution and elimination reactions. The mechanistic basis for organic compound reactivity and the development of chemical intuition regarding why chemical reactions happen is also central to the course. In addition, modern analytical techniques that are used in the structural characterization of organic compounds such as polarimetry, infrared spectroscopy, gas chromatography-mass spectrometry and nuclear magnetic resonance spectroscopy are introduced.

**Academic Level:** Undergraduate

**Corequisites:** CHE 250L, CHE 250S

**CHE 250L University Organic Chemistry I Lab**

The corequisite laboratory for University Organic Chemistry I (CHE 250L) is supported by the laboratory lecture, CHE 250S. The lab is built upon scientific methods of inquiry through research, stressing the development of professional competencies, lab skills development, and the use of green chemistry principles. Microscale and selected mini/macroscale techniques for organic compound synthesis, analysis, isolation, visualization, and purification will be learned. Spectroscopic techniques and analyses such as UV-visible spectroscopy, infrared spectroscopy, gas chromatography-mass spectrometry, polarimetry, and nuclear magnetic resonance spectroscopy are also studied in context. Students gain experience in experimental design to test a hypothesis, proposing logical "next step" experiments using qualitative and quantitative data, and learn to monitor the progress of organic reactions using qualitative data and spectroscopic solutions.

**Academic Level:** Undergraduate

**Corequisites:** CHE 250, CHE 250S

**CHE 250S University Organic Chemistry I Lab Lecture**

University Organic Chemistry laboratory lecture (CHE 250S) is an essential co-requisite component to the CHE 250 course. CHE 250S course is a one-hour weekly course that serves to prepare students for upcoming experiments by fostering discussion of laboratory techniques, concepts and data; promoting an environment where students can design and plan for next experiments; and integrating theory and lab skills components of CHE 250.

**Academic Level:** Undergraduate

**Corequisites:** CHE 250, CHE 250L

**CHE 251 University Organic Chemistry II (5 Credit Hours)**

This is the second half of a comprehensive one-year course suitable for science majors that has an accompanying corequisite laboratory and laboratory lecture. The CHE 251 course includes the study of mechanistic patterns and the application of these patterns to reactions involving multistep mechanisms, such as addition, redox, condensation, radical, cycloaddition, and more. In addition, modern analytical techniques (e.g. nuclear magnetic resonance spectroscopy, UV-visible spectroscopy and mass spectrometry) used in the identification of organic compounds will be discussed in greater detail.

**Academic Level:** Undergraduate

**Corequisites:** CHE 251L, CHE 251S

**CHE 251L University Organic Chemistry II Lab**

The corequisite laboratory for University Organic Chemistry II (CHE 251L) is supported by the laboratory lecture, CHE 251S, and is a continuation of the first semester experience. The CHE251L further stresses inquiry through research, emphasizing the development of professional competencies, lab skills development, and the use and awareness of green chemistry principles, as applied to multistep reaction processes. Techniques of compound analysis, multistep synthesis, purification, separation, and the hand-on use of instrumentation will be practiced, with students having opportunities for exploration of their individual interests within the laboratory framework. The development of scientific communication skills (e.g. oral, written and poster formats) is emphasized, while the utilization of field-specific databases, software and search tools are expected. Advanced application of the spectroscopic techniques Nuclear Magnetic Resonance spectroscopy, mass spectrometry, infrared spectroscopy, UV-Visible spectroscopy, and polarimetry are also explored in context of student experimentation.

**Academic Level:** Undergraduate

**Corequisites:** CHE 251, CHE 251S

**CHE 251S University Organic Chemistry II Lab Lecture**

University Organic Chemistry II laboratory lecture CHE 251S is a required component to the CHE 251 course. CHE 251S course is a one-hour weekly course that serves to prepare students for upcoming experiments by fostering discussion of laboratory techniques, concepts and data; promoting an environment where students can design and plan for next experiments; and integrating theory and lab skills components of CHE 251.

**Academic Level:** Undergraduate

**Corequisites:** CHE 251, CHE 251L

**CHE 280 Intermediate Inorganic Chemistry (3 Credit Hours)**

Descriptive inorganic chemistry, including discussion of transition metal chemistry, coordination compounds, organometallics, and main-group elements; atomic structure; ionic and covalent molecular substances, including discussion of MO theory. Laboratory component will include routine synthesis of coordination complexes and measurements associated with structure identification.

May be repeated for credit.

**Academic Level:** Undergraduate

**Corequisites:** CHE 280L

**CHE 280L Intermediate Inorganic Chemistry Lab**

**Academic Level:** Undergraduate

**Corequisites:** CHE 280

**CHE 300 Topics in Chemistry (1-3 Credit Hours)**

This course, designed in collaboration with a faculty member, allows students to explore in detail selected chemistry or biochemistry topics that are not ordinarily covered in other courses in the curriculum.

Permission of instructor required.

May be repeated for credit.

**Academic Level:** Undergraduate

**CHE 307 Quantitative Analysis (5 Credit Hours)**

An introduction to the theory and practice of analytical chemistry, utilizing both classical and instrumental methods. Accuracy, precision, and the interpretation of analytical data; the understanding of theoretical concepts, especially ionic Equilibria; and proper performance of lab techniques are stressed. The course is suitable for students interested in the chemical, marine, and environmental sciences, as well as those interested in experimental biology or clinical aspects of chemical analysis. Includes a weekly lab (CHE 307L).

**Academic Level:** Undergraduate

**Corequisites:** CHE 307L

**CHE 307L Quantitative Analysis Lab**

Laboratory experience using classical and instrumental analytical methods, to accompany CHE 307.

**Academic Level:** Undergraduate

**Corequisites:** CHE 307

**CHE 310 Fundamentals of Biochemistry (4 Credit Hours)**

A survey of the structural, functional, and informational aspects of biologically important molecules, such as amino acids, carbohydrates, and lipids, are studied in view of proteins and enzymes. In addition, several core metabolic pathways including glycolysis, the citric acid cycle, electron transport chain, and oxidative phosphorylation are discussed. This course is accompanied by a corequisite lab and may not be taken for credit after passing CHE 350.

May be repeated for credit.

**Academic Level:** Undergraduate

**Corequisites:** CHE 310L

**CHE 310L Biochemistry Lab**

This laboratory course is a co-requisite for the lecture course CHE 310. Students enhance conceptual understanding of fundamental biochemical principles by demonstrating competency with core biochemistry lab techniques, including the analysis of data from experiments using these techniques. Laboratory skills in colorimetric detection of proteins, SDS-PAGE, PCR, and enzyme assays are studied in the context of a multi-week research project.

**Academic Level:** Undergraduate

**Corequisites:** CHE 310

**CHE 315 Hit It a Ton: The Impact of STEM fields on Sports (3 Credit Hours)**

Professional sports in the United States is a big business, generating more than 35 billion dollars in yearly revenues. The tactics, strategies, and landscapes of these sports continually evolve as players, coaches, and front office personnel find new ways to best their opponents. In this course, we explore how the STEM (Science, Technology, Engineering, and Mathematics) fields change the games we all love. Topics include the impact of material science on individual sports, such as golf – focusing on club and ball technology, and data science on team sports, such as baseball and basketball – focusing on advanced statistics development.

**Academic Level:** Undergraduate

**CHE 327 Applied Physical Chemistry (3 Credit Hours)**

An introduction to the essentials of physical chemistry and its applications. Includes the following topics: thermodynamics, chemical kinetics, properties of state, phase equilibria, solutions, atomic structure, bonding, and molecular spectroscopy.

**Academic Level:** Undergraduate

**CHE 350 Biochemistry I: Proteins (5 Credit Hours)**

This course is the first half of the two-semester biochemistry sequence that is accompanied by a corequisite lab. The structure, dynamics, and function of proteins are explored in this lecture course. Specific topics include protein structure and folding, ligand binding, enzyme mechanisms, kinetics, regulatory strategies, signal transduction, and the use of scientific databases and software tools.

**Academic Level:** Undergraduate

**Corequisites:** CHE 350L

**CHE 350L Biochemistry I Proteins Lab**

This lab course, a co-requisite for the lecture course CHE 350, teaches integrated lab concepts for protein study, essential biochemical techniques and data analysis within the context of a research-inspired laboratory.

May be repeated for credit.

**Academic Level:** Undergraduate

**Corequisites:** CHE 350

**CHE 351 Biochemistry II: Metabolism/Bioenergetics (3 Credit Hours)**

This lecture course is the second half of the two-semester biochemistry sequence. This course surveys the interconnecting metabolic pathways that result in the biosynthesis and catabolism of carbohydrates, lipids and amino acids in animals and plants. Signal transduction pathways and other cellular mechanisms regulating these pathways are also explored, as are the consequences of abnormal metabolism in human disease. The course covers topics that include cellular energetics, signaling pathways, glycolysis, glycogen metabolism, citric acid cycle, pentose phosphate pathway, gluconeogenesis, lipid synthesis/oxidation, urea cycle, integrative metabolism and photosynthesis.

May be repeated for credit.

**Academic Level:** Undergraduate

**CHE 370 Physical Chemistry I (4 Credit Hours)**

A theoretical and experimental exploration of the underlying physical principles that govern the properties and behavior of chemical systems, viewed from both macroscopic and microscopic perspectives. Topics include quantum mechanics, atomic and molecular spectroscopy, and statistical mechanics. Includes a weekly three-hour laboratory.

May be repeated for credit.

**Academic Level:** Undergraduate

**Corequisites:** CHE 370L

**CHE 370L Physical Chemistry I Lab**

The co-requisite laboratory accompanying CHE 370. An experimental and computational investigation of molecular spectroscopies, including UV-Vis, IR, NMR, and fluorescence, that illustrates important principles and techniques, includes methods of data analysis, and applies quantum mechanical models to results.

May be repeated for credit.

**Academic Level:** Undergraduate

**Corequisites:** CHE 370

**CHE 375 Advanced Laboratory (2 Credit Hours)**

An advanced, project-based, integrated laboratory course incorporating the concepts and techniques of analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, and physical chemistry

May be repeated for credit.

**Academic Level:** Undergraduate

**CHE 380 Inorganic Chemistry (3 Credit Hours)**

An introduction to the principles of inorganic structure and bonding, including molecular symmetry, atomic structure, and molecular and ionic bonding. Topics also include the chemistry of the transition metals, with emphasis on the stereochemistry, reaction mechanisms, and chemical reactivity of coordination complexes and organometallics.

May be repeated for credit.

**Academic Level:** Undergraduate

**CHE 401 Seminar (1 Credit Hours)**

A weekly seminar series in chemistry and biochemistry featuring presentations by UNE faculty and students and invited guest speakers on original research or topics from the current literature. Enrolled students will present at least one talk during the semester.

**Academic Level:** Undergraduate

**CHE 405 Medicinal Chemistry (3 Credit Hours)**

This capstone course explores the chemical foundation of a drug's biological activity. Topics will include the research, development, and regulatory processes for bringing a drug from concept to market. Using common drug classes such as analgesics, anticancer agents, and antibacterial drugs, special attention will be given to the relationship between organic structure and biological activity using in vitro and in vivo data. Theories of structure-based design will also be studied.

**Academic Level:** Undergraduate

**CHE 407 Instrumental Methods Analysis (5 Credit Hours)**

An exploration of the theory, operation, and analytical applications of modern chemical instrumentation. Topics covered include basic analog and digital electronics, atomic and molecular absorption and emission spectroscopy, electroanalytical chemistry, and chromatographic methods.

May be repeated for credit.

**Academic Level:** Undergraduate

**Corequisites:** CHE 407L, CHE 407S

**CHE 407L Instrumental Analysis Lab**

May be repeated for credit.

**Academic Level:** Undergraduate

**Corequisites:** CHE 407, CHE 407S

**CHE 407S Instrumental Analysis Recit**

**Academic Level:** Undergraduate

**Corequisites:** CHE 407, CHE 407L

**CHE 410 Research I (1-4 Credit Hours)**

Directed research in Chemistry or Biochemistry carried out in collaboration with a faculty mentor. Third or Fourth year standing and permission of instructor required.

May be repeated for credit.

**Academic Level:** Undergraduate

Enrollment limited to students with the UG Research attribute.

**CHE 411 Research II (1-4 Credit Hours)**

A continuation of CHE 410. Permission of the instructor required.

May be repeated for credit.

**Academic Level:** Undergraduate

Enrollment limited to students with the UG Research attribute.

**CHE 417 Instrumental Methods of Analysis (4 Credit Hours)**

An exploration of the theory, operation, and analytical applications of modern chemical instrumentation. Topics covered include basic analog and digital electronics, atomic and molecular absorption and emission spectroscopy, electroanalytical chemistry, and chromatographic methods. Additional instrumental methods may be covered as time permits. Includes laboratory.

**Academic Level:** Undergraduate

**Corequisites:** CHE 417L

**CHE 417L Instrumental Methods Lab**

Laboratory experience using modern chemical instrumentation, to accompany CHE 417.

**Academic Level:** Undergraduate

**Corequisites:** CHE 417

**CHE 450 Advanced Biochemistry Lab (3 Credit Hours)**

A research-based laboratory capstone course that provides students with experience in research methods and techniques that are commonly used in the study of biochemical processes. Under the guidance of a faculty member, students design and implement a strategy to test a hypothesis on a defined research project. Methods utilized in the project may include cloning, protein expression, protein purification, chemical synthesis of peptides, cell culture, immunocytochemistry, qPCR, enzymatic assays, and analysis of metabolites using NMR spectroscopy and/or LCMS.

**Academic Level:** Undergraduate

**CHE 495 Advanced Chemistry Internship (3-9 Credit Hours)**

An internship is a high impact learning experience where knowledge and theory from students' program of study are integrated with shadowing, volunteering or paid employment with a private company, not-for-profit organization or government agency toward the intentional development of transferable knowledge, skills and abilities and practical application of professional competencies. The semester prior to the internship, Academic and Career Advising Center staff assist students with preparing their application materials and searching and applying for Chemistry related internships within the local community, stateside or abroad, as well as in defining learning objectives, educational and career goals, and professional deliverables to be met throughout the course of training and practice. During the semester of the internship course, under the mentorship of a dedicated professional who has the education and/or background and expertise of the students' discipline of study, students immerse in a remote, hybrid or in-person professional setting. Through guidance, support and regular feedback from the mentor and the course instructor, students strive to satisfactorily learn and practice their internship position and achieve their learning objectives. Students follow a course curriculum including: 40 contact hours at the host site per credit hour registered; participation in classes, meetings or workshops as scheduled by the course instructor; timely completion of homework assignments in support of student learning outcomes, professional readiness and career exploration; and end of semester evaluations. Internships culminate in a letter grade determined by the above criteria. Written pre-approval of the internship by the course instructor and Academic Director is required.

**Academic Level:** Undergraduate

Enrollment limited to students with the UG Internships attribute.

**CHE 550 Biochemistry I:Proteins (5 Credit Hours)**

This course is the first half of the two-semester biochemistry sequence that is accompanied by a co-requisite lab for graduate students. The structure, dynamics, and function of proteins are explored in this lecture course. Specific topics include protein structure and folding, ligand binding, enzyme mechanisms, kinetics, regulatory strategies, signal transduction, and the use of scientific databases and software tools. As a graduate-level course, students learn how to prepare a literature review and an original research proposal. Graduate level standing is required.

**Academic Level:** Graduate

**Corequisites:** CHE 550L

**CHE 550L BiochemistryI: Proteins Lab**

This lab course, a co-requisite for the lecture course CHE 550, teaches integrated lab concepts for protein study, essential biochemical techniques and data analysis within the context of a research inspired laboratory. Graduate level standing is required.

**Academic Level:** Graduate

**Corequisites:** CHE 550

**CHE 551 Biochemistry II: Metabolism/Bioenergetics (3 Credit Hours)**

This graduate course surveys the interconnecting metabolic pathways that result in the biosynthesis and catabolism of carbohydrates, lipids and amino acids in animals and plants. Signal transduction pathways and other cellular mechanisms regulating these pathways are also explored, as are the consequences of abnormal metabolism in human disease. The course covers topics that include cellular energetics, signaling pathways, glycolysis, glycogen metabolism, citric acid cycle, pentose phosphate pathway, gluconeogenesis, lipid synthesis/oxidation, urea cycle, integrative metabolism and photosynthesis. As a graduate level version of CHE 351, this course will contain additional rigorous assignments including literature reviews and preparation of an original research proposal. Graduate level standing is required.

May be repeated for credit.

**Academic Level:** Graduate

**CHE 597 Independent Study (1-9 Credit Hours)**

In this course students pursue studies under the supervision of a faculty sponsor. Students may engage in study of topics which are not part of the regularly offered courses. A carefully prepared written plan of study and evaluation approved in advance by the instructor is required.

**Academic Level:** Graduate

Enrollment is limited to students with a major in Environmental Studies Scienc, Biological Sciences, Environmental Science 4+1, Environmental Studies 4+1 or Marine Sciences.