CHEMISTRY AND BIOCHEMISTRY

Science Building, Room 550
201-200-3069

The Chemistry and Biochemistry Department offers multiple degree programs providing students with the skills and knowledge to pursue employment opportunities in both government and private industries or to pursue post-graduate degrees in graduate or professional schools such as medical or dental school. Furthermore, the Chemistry and Biochemistry Department faculty have a broad range of research interests including analytical chemistry, biochemistry, medicinal chemistry, organic synthesis and methodology, material science, computational chemistry and environmental and forensic science. The available instrumentation in the department supporting teaching and research is extensive and includes a LC-MS, FTIR, AAS, IC, HPLC, GC-MS, 3D printer, SEM, IR microscope, NanoDrop OneC spectrophotometer, GE Healthcare ÄTKA pure 25L fast protein liquid chromatography (FPLC) system, Evos Floid inverted fluorescence microscope with CCD camera and capillary electrophoresis. Computational Resources including a GPU-based molecular dynamics cluster. Students have multiple opportunities to participate in original research and share their research accomplishments both locally and at national meetings.

The Chemistry and Biochemistry Department is an active participant of the American Chemical Society and the American Society for Biochemistry and Molecular Biology (ASBMB). In addition, the Department has an active student-run Chemistry Club and ASBMB student Chapter.

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Various discipline-specific concentrations that will prepare students for multiple fields of employment or areas of additional undergraduate/graduate study are noted below. Course requirements for each concentration are explained in detail. The requirements for graduation, in addition to completion of the major area, are listed on "Undergraduate Degree Requirements (https://catalog.njcu.edu/undergraduate/undergraduate-degree-requirements/)."

- Biochemistry, B.S. (https://catalog.njcu.edu/undergraduate/arts-sciences/chemistry/biochemistry-bs/)
- Chemistry, B.A. (https://catalog.njcu.edu/undergraduate/arts-sciences/chemistry/chemistry-ba/)
- Chemistry, B.S.
- Chemistry, Minor (https://catalog.njcu.edu/undergraduate/arts-sciences/chemistry/chemistry-minor/)

Chemistry (CHEM)

CHEM 1XX Chemistry Transfer Credit (0 Credits)

CHEM 2XX Chemistry Transfer Credit (0 Credits)

CHEM 100 Preparation for General Chemistry (3 Credits)
This course or passing a "pre-test" is required before taking Chemistry 105. No laboratory work is done. Measurement, exponential notation, problem solving, graphing and basic chemistry concepts are discussed. Credits are not included as part of major or minor.
Pre-Requisite(s): or Co-Requisite(s): MATH 112 Intermediate Algebra
Co-Requisite(s): MATH 112 Intermediate Algebra

CHEM 105 General Chemistry I Lecture (3 Credits)
This course provides a qualitative and quantitative description of atomic and molecular structure, gas laws, stoichiometry, thermodynamics, and solution chemistry. This course meets the requirements for students majoring in the biological and physical sciences.
Pre-requisite: CHEM 100 Preparation for General Chemistry I
Co-requisite: CHEM 1105 General Chemistry I, Recitation/Laboratory

CHEM 106 General Chemistry II Lecture (3 Credits)
This course is a continuation of Chemistry 105. Topics discussed include equilibrium, acids and bases, precipitation reactions, kinetics and electrochemistry.
Pre-Requisite(s): CHEM 105 General Chemistry I, Lecture
Co-Requisite(s): CHEM 1106 General Chemistry II, Recitation/Laboratory.

CHEM 130 The Chemistry of Everyday Things (3 Credits)
This course is an elective for non-science majors that will present chemical phenomena using basic concepts of chemistry. Students will learn how matter forms and changes in qualitative fashion, Course will focus on the comprehension of concepts and the application of the concepts of everyday things,

CHEM 131 Chemistry in the Kitchen: Learning Chemistry through Food and Cooking (3 Credits)
Many cooking shows on television are successful even though the chefs don't explain the why of their actions cooking, they are just now getting around to learning the chemistry behind the cooking. This course is about the need to know facts of chemistry that are essential to understanding food and cooking.

CHEM 140 Making the Case: Forensic Science (3 Credits)
Course is intended to provide students with practical experience in forensic science including collection techniques and the characterization of physical evidence paramount to the prosecution process. The qualitative and quantitative evaluation of physical evidence will be examined by classical and instrumental methods.

CHEM 205 Analytical Chemistry Lec (3 Credits)
Precipitation reactions, acid-base phenomenon, spectral analysis, complex formation, and electrochemistry are discussed. The use of statistics in analytical chemistry are also covered.
Pre-Requisite(s): CHEM 106, CHEM 1106
Co-Requisite(s): CHEM 2205

CHEM 207 Organic Chemistry I (3 Credits)
This course will introduce the theory and concepts of modern organic chemistry. Topics include structure and bonding and acid/base theory applied to organic compounds, stereochemistry, conformational analysis, and an introduction to organic functional groups, organic synthesis and spectroscopy.
Pre-Requisite(s): CHEM 105 and CHEM 1105 and Co-requisite CHEM 2207
Co-requisite: CHEM 2207

CHEM 208 Organic Chemistry II (3 Credits)
A continuation of Organic Chemistry I lecture, this course will advance student understanding of the theory and concepts of organic chemistry via the study of an array of chemical reactions and mechanisms including aromaticity, carbonyl chemistry, oxidation and reduction reactions, and the study of important functional groups.
Pre-Requisite(s): CHEM 207 Organic Chemistry I and CHEM 2207 Organic Chemistry I Lab

CHEM 220 Environmental Chemistry (4 Credits)
Environmental Chemistry is designed as a one-semester chemistry course including a lecture and laboratory component. This course is intended to provide the student with an understanding of the key environmental issues our world faces, by exploring the chemistry of our air, water and soil and the human interaction with these environmental processes. Contemporary environmental problems such as: ozone formation/ destruction, photochemical smog, acid rain, the greenhouse effect, metal and nutrient fluxes, erosion and deforestation, sewage treatment, and conservation will be addressed by using chemical concepts (i.e.; equilibrium, oxidation-reduction reactions, kinetics, solubility, acid-base chemistry, and thermodynamics). Laboratory work will focus on monitoring and environmental quality of air, water and soil samples.
Pre-Requisite(s): CHEM 106 and CHEM 1106

CHEM 225 Forensic Science Laboratory (2 Credits)
This course is intended to provide students with practical experience in forensic science. Collection techniques and the characterization of physical evidence is paramount to the prosecution process. The qualitative and quantitative evaluation of physical evidence will be examined by classical and instrumental methods.
Pre-Requisite(s): CHEM 111 and Co-Requisite CHEM 112
Co-Requisite: CHEM 112

CHEM 230 Chemistry Through Society: Better Living Through Chemistry (3 Credits)
This course emphasizes the relevance of chemistry in every day life, as it relates to solving major problems in society. Students will learn to examine chemical phenomena important in real-world needs innovations, such as drug, design/approval, biotechnology, energy, global climate change, genetically modified food, and other societal concerns.

CHEM 305 Physical Chemistry I (3 Credits)
Elementary aspects of thermodynamics with applications to gases, liquids, crystals, chemical equilibria, solutions, and electrochemistry are taught in this course.
Pre-Requisite(s): MATH 193

CHEM 306 Physical Chemistry II, Lecture (3 Credits)
This course provides emphasis on microscopic properties, kinetic theory of gases, statistical mechanics, elementary quantum chemistry and spectroscopic methods of molecular structure determination.
Pre-requisite: MATH 193

CHEM 307 Biochemistry I (4 Credits)
This course presents the structure and properties of proteins, fats, carbohydrates, nucleic acids, vitamins, and enzymes. Laboratory work includes methods for the identification of biological compounds.
Pre-Requisite: CHEM 207

CHEM 308 Biochemistry II (4 Credits)
Pre-requisite: CHEM 307 Biochemistry I

CHEM 310 Introduction to Computational Chemistry (3 Credits)
This course provides the essential theoretical background of computational chemistry as well as the practical skills to perform computations to solve chemical problems. The concepts of chemical bonding, reactivity, molecular properties, and spectroscopy are explained from the electronic perspective. Students are exposed to modern computational chemistry software.
Pre-Requisite(s): CHEM 305 Physical Chemistry I

CHEM 316 Instrumental Analysis, Lecture (3 Credits)
The theories of ultraviolet, visible and infrared spectroscopy, gas chromatography, mass spectrometry, and NMR analyses are presented in this course.
Pre-Requisite(s): CHEM 205 and CHEM 2205
Co-requisite: CHEM 3316.

CHEM 401 Medicinal Chemistry (3 Credits)
This course will examine the properties and relationship of drug molecules, specific drug classes and structure, phsico-chemical properties, mechanism of drug interactions, synthesis of classes of drugs, the characteristics of drug receptors, drug metabolism, and pharmacokinetics.
Pre-Requisite(s): CHEM 208: Organic Chemistry II

CHEM 405 Seminar (1 Credit)
A study of the chemical literature for the purpose of preparing a detailed presentation to the chemistry faculty and students is presented in this course.
Pre-Requisite(s): CHEM 208 Organic Chemistry II.

CHEM 406 Introduction to Polymer Chemistry (4 Credits)
This course is a study of the organic and physical chemistry of high polymers, including methods of preparation, chemical and physical properties, and structure property relationships.
Pre-Requisite(s): CHEM 208 and CHEM 305

CHEM 412 Inorganic Chemistry Laboratory (2 Credits)
This course provides a foundation in experimental inorganic and organometallic chemistry. Lab techniques such as vacuum and inert atmosphere, sublimation, crystallization, and evaporative procedures along with advanced NMR ('H, 13C, and 31P), visible and IR spectroscopic, magnetic susceptibility and electrochemical methods will be used to investigate these molecular systems.
Pre-Requisite(s): CHEM 316

CHEM 414 Advanced Organic Chemistry (3 Credits)
This advanced course in organic chemistry covers topics including retrosynthetic analysis, modern synthetic methods, organometallic chemistry and stereoselective synthesis. Techniques will be illustrated by the study of the total synthesis of natural products and phamaceutically important molecules.
Pre-Requisite(s): CHEM 208 Organic Chemistry II

CHEM 416 Inorganic Chemistry (3 Credits)
Selected topics from inorganic chemistry at an advanced level are presented in this course. The stereochemistry, kinetics, and mechanisms of inorganic reactions are emphasized.
Pre-Requisite(s): CHEM 208

CHEM 420 Food Chemistry (4 Credits)
Food Chemistry is designed as a one-semester upper-level chemistry course which includes a lecture and laboratory component. This course is intended to provide the student with an understanding of the key mechanistic and chemical transformations of foods. All phenomena observed in preparing food will be examined in terms of classical chemical terms and concepts. This course will explore how water, lipids, proteins, carbohydrates, vitamins and food additives impact the texture, nutritional properties and flavor of foods. The laboratory work will provide students with an opportunity to investigate these individual components and chemical changes that occur in foods.
Pre-Requisite(s): CHEM 205 and CHEM 208

CHEM 425 Nanomaterial and Microelectronic Fabrication (3 Credits)
The design and construction of nanomaterials and the microelectronic fabrication technologies are critical to the success of discovering new materials with novel properties. The fabrication and characterization of nanomaterials and the processing of these materials into nano and microdevices will be explored.
Pre-Requisite(s): CHEM 205 and CHEM 2205

CHEM 430 Spectroscopic Identification of Organic Compounds (3 Credits)
This course provides students with a comprehensive understanding of molecular structural interpretation integrated with improved knowledge and synthetic skills needed in the chemical sciences. Topics covered in this course will use a variety of modern analytical instrumental techniques combined with comprehensive synthetic and analytical projects.
Pre-Requisite(s): CHEM 208

CHEM 431 Industrial Aspects of Chemistry (3 Credits)
This course is a study of the process for making industrial chemicals and the influences of energy, environment and safety regulations on industry. Rudiments of chemical engineering and business and economic practices which govern the management of chemical and pharmaceutical industries are discussed.
Pre-Requisite(s): CHEM 208 Organic Chemistry II.

CHEM 435 Materials Chemistry (3 Credits)
The Materials Chemistry course will provide an understanding and appreciation of the structure and properties of new materials at the nanodimensional level. Important concepts in material science and nanotechnology such as: molecular templating, chemical patterning strategies, molecular electronic components, and new synthetic techniques and analytical tools will also be discussed.
Pre-Requisite(s): CHEM 205 and CHEM 2205.

CHEM 491 Chemistry Research (1 Credit)
Chemistry majors are encouraged to participate in chemical research under the guidance and supervision of a faculty mentor. This course does not replace other chemistry requirements and a final written paper is required. Requirement: The permission of the instructor and the approval of the chairperson and sophomore, junior, or senior status.

CHEM 492 Chemical Research (2 Credits)
Chemistry majors are encouraged to participate in chemical research under the guidance and supervision of a faculty mentor. This course does not replace other chemistry requirements and a final written paper is required. Requirement: The permission of the instructor and the approval of the chairperson and sophomore, junior, or senior status.

CHEM 493 Chemical Research (3 Credits)
Chemistry majors are encouraged to participate in chemical research under the guidance and supervision of a faculty mentor. This course does not replace other chemistry requirements and a final written paper is required. Requirement: The permission of the instructor and the approval of the chairperson and sophomore, junior, or senior status.

CHEM 1105 General Chemistry I Recitation/Laboratory (2 Credits)
Taken concurrently with Chemistry 105, this course provides experiences which allow the student to discover the empirical relationships which support the theoretical aspects of General Chemistry I.
Co-Requisite(s): CHEM 105 General Chemistry I, Lecture

CHEM 1106 General Chemistry II Recitation/Laboratory (2 Credits)
A continuation of Chemistry 1105, the course includes titrations, spectrophotometric work, the use of pH meters, and qualitative analysis. It is taken concurrently with Chemistry 106.
Co-Requisite(s): CHEM 106 General Chemistry II, Lecture

CHEM 1492 Indepedent Study Chemistry (2 Credits)
Chemistry majors are encouraged to undertake independent laboratory-oriented projects. These courses do not replace other chemistry requirements.

CHEM 2205 Analytical Chemistry Laboratory (2 Credits)
This course taken with Chemistry 205, includes gravimetric, volumetric, spectrophotometric, and potentiometric techniques.
Co-Requisite(s): CHEM 205 Analytical Chemistry, Lecture

CHEM 2207 Organic Chemistry I Laboratory (1 Credit)
By hands on participation, students in this course will be introduced to the theory and techniques of the modern organic chemistry laboratory such as extraction, thin layer chromatography, purification, and gas-liquid chromatography. The student will apply these techniques to the synthesis of organic molecules from several important functional group classes.
Pre-Requisite(s): CHEM 106 and1106

CHEM 2208 Organic Chemistry II Laboratory (1 Credit)
A continuation of Organic Chemistry I Lab, students in this course will advance their study of the techniques and theory of modern organic chemistry via the study of an array of chemical reactions used to prepare important functional group classes such as aromatic compounds ketones, alcohols and hydrazones.
Pre-Requisite(s): CHEM 207 and CHEM 2207

CHEM 3305 Physical Chemistry I Recitation/Laboratory (2 Credits)
This course looks at experimental determination of molecular and equilibrium properties of pure substances and solutions. The operation and calibration of instruments are stressed. Recitation-problem solving is stressed.
Co-Requisite(s): CHEM 305 Physical Chemistry I, Lecture

CHEM 3306 Physical Chemistry II Recitation/Laboratory (2 Credits)
A continuation of Chemistry 3305, the course emphasizes electrochemistry, calorimetry, and the kinetic properties of reactive systems. Recitation-problem solving is stressed.
Co-Requisite(s): CHEM 306 Physical Chemistry II, Lecture

CHEM 3316 Instrumental Methods of Analysis, Laboratory (2 Credits)
This course gives students practical experience in the use of modern instruments including ultraviolet, infrared, atomic absorption, nuclear magnetic resonance and mass spectroscopy, gas chromatography, and polarography.
Co-requisite: CHEM 316 Instrumental Analysis, Lecture

Physics (PHYS)

PHYS 1XX Physics Transfer Credit (0 Credits)

PHYS 2XX Physics Transfer Credit (0 Credits)

PHYS 100 Preparation for Physics (3 Credits)
Measurement, trigonometry, vectors, problem solving, graphing and basic physical concepts are discussed. This lecture course is required before taking PHYS 130 or PHYS 140. Credits are not included as part of major or minor.
Pre-Requisite: or Co-Requisite: MATH 175
Co-Requisite: MATH 175

PHYS 101 Basic Concepts of Physics (3 Credits)
This is a one-semester course, which gives an overview of the basic principles of physics including mechanics, heat, electricity and magnetism, light and sound, and modern physics.

PHYS 140 Principles of Physics I - Lecture (3 Credits)
This course develops the concepts and laws of mechanics, especially conservation laws, and includes scalar and vector quantities: rectilinear and circular motion; equilibrium; work energy and momentum; elements of fluid statics and dynamics; heat and thermodynamics. Instruction includes 4 hours of lecture, demonstration/discussion and problem solving per week with emphasis on applications.
Prerequisite: PHYS 100 and Co-requisite: MATH 192 Calculus and Analytic Geometry I AND PHYS 1140 Principles of Physics I - Laboratory and recitation
Co-requisite: MATH 192 Calculus and Analytic Geometry I AND PHYS 1140 Principles of Physics I - Laboratory and recitation

PHYS 141 Principles of Physics II - Lecture (3 Credits)
This course is a continuation of Physics 140 and develops a conceptual, quantitative and applied understanding of electric field and electrostatics; DC circuits; magnetic fields and properties of matter; AC circuits electromagnetic waves; geometric and wave optics. Instruction includes 4 hours lecture, demonstration/discussion and problem solving per week with emphasis on applications.
Pre-requisite: PHYS 140 Physics for Engineering I Lecture, Co-requsite PHYS 1141 Principles of Physics II - Laboratory and Recitation

PHYS 1140 Principles of Physics I - Laboratory and recitation (1 Credit)
Correlated student laboratory experiments for most areas cited in PHYS 140 are performed to verify or discover the principles of physics. Instruction includes structured and open-ended laboratory experiments with recitation.
Co-Requisite(s): PHYS 140 Principles of Physics I - Lecture

PHYS 1141 Principles of Physics II - Laboratory and Recitation (1 Credit)
Correlated student laboratory experiments for most areas cited in PHYS 141 are performed to verify or discover the principles of physics. Instruction includes structured and open-ended laboratory experiments with recitation.
Co-Requisite(s): PHYS 141 Principles of Physics II - Lecture