

CHEMISTRY (CE)

CE-101 Chemistry in Our Lives

Credits: 3

Term Offered: All Terms

Course Type(s): NS

Major concepts and methodologies in chemistry and their relation to specific, important issues in today's society.

CE-109 Introduction to General, Organic, and Biochemistry

Credits: 4

Prerequisite(s): Score of 3 or higher on the Mathematics Placement Exam, or MA-105 passed with a grade of C- or higher.

Course Type(s): None

Structure of matter, the mole concept, chemical bonds and reactions, acids and bases, structure and reactions of organic compounds, chemistry and metabolism of amino acids, carbohydrates, lipids, proteins, and nucleic acids. Three hours of class, three hours of lab per week. Students must have had High School Chemistry to take this course.

CE-111 General Chemistry I

Credits: 3

Prerequisite(s): Score of 2 or higher on the Mathematics Placement Exam or MA-050 passed with a grade of C- or higher

Co-requisite(s): CE-111L

Term Offered: All Terms

Course Type(s): NS

The first of two lecture courses which, taken together, provide a preparation for subsequent courses in chemistry. Principles and theories of chemical problem solving, stoichiometry and chemical reactions, states of matter, periodic properties of the elements, atomic and molecular structure, introductory quantum mechanics, thermochemistry, and the properties of gases are covered.

CE-111L General Chemistry I Laboratory

Credits: 1

Co-requisite(s): CE-111

Term Offered: All Terms

Course Type(s): None

Laboratory work to complement the class work of CE-111 and CE-112; review of mathematical fundamentals; experiments involving observation and interpretation of chemical and physical changes; experimental studies of gas laws, thermodynamics, kinetics, equilibrium, acids and bases, qualitative analysis, and molecular mass determination. Three hours per week.

CE-111R General Chemistry I Recitation

Credits: 1

Co-requisite(s): CE-111 and CE-111L

Term Offered: All Terms

Course Type(s): None

Gen Chem 1 Recitation supports General Chemistry 1 students with active learning activities such as group problem solving and peer-led team learning that focus on the key or most challenging aspects of the General Chemistry 1 course. Assessment activities, including quizzes, are included in Gen Chem 1 Recitation. Gen Chem 1 is a Pass/Fail corequisite for CE 111 - General Chemistry 1. Corequisite: CE-111 and CE-111L

CE-112 General Chemistry II

Credits: 3

Prerequisite(s): CE-111 passed with a grade of C- or higher, CE-111L passed with a grade of C- or higher, and either MA-101 passed with a grade of C- or higher or a score of 3 or higher on the Mathematics Placement Exam.

Co-requisite(s): CE-112L

Term Offered: All Terms

Course Type(s): NS

The second of two lecture courses which, taken together, provide preparation for subsequent courses in chemistry. Properties of liquids and solutions, chemical kinetics and equilibrium, thermodynamics, electrochemistry and nuclear chemistry.

CE-112L General Chemistry II Laboratory

Credits: 1

Co-requisite(s): CE-112

Course Type(s): None

Laboratory work to complement the class work of CE-111 and CE-112; review of mathematical fundamentals; experiments involving observation and interpretation of chemical and physical changes; experimental studies of gas laws, thermodynamics, kinetics, equilibrium, acids and bases, qualitative analysis, and molecular mass determination. Three hours per week.

CE-112R General Chemistry II Recitation

Credits: 1

Prerequisite(s): CE-111 and CE-111L both passed with a grade of C- or higher; CE-111R.

Co-requisite(s): CE-112 and CE-112L

Term Offered: All Terms

Course Type(s): None

Chem 2 Recitation supports General Chemistry 2 students with active learning activities such as group problem solving and peer-led team learning that focus on the key or most challenging aspects of the General Chemistry 1 course. Assessment activities, including quizzes, are included in Gen Chem 2 Recitation. Gen Chem 2 Recitation is a Pass/Fail corequisite for CE-112.

CE-198 Special Topics in Chemistry (100 Level)

Credits: 1-3

Course Type(s): None

An intensive study of a particular subject or problem in chemistry to be announced prior to registration. May be conducted on either a lecture-discussion or a seminar basis. If a prerequisite is required it will be announced in the course schedule.

CE-220 Environmental Chemistry

Credits: 3

Prerequisite(s): CE-112 and CE-112L, both passed with a grade of C- or higher

Co-requisite(s): CE-220L

Course Type(s): MEBP

Soil, aquatic, and atmospheric chemistry; environmental analytical chemistry; connections to environmental biology. Sources, reactions, mobility, effects, and fates of chemical species in the soil, water and air environments and the effect of human activity on these. Gives the theoretical principles and techniques of both classical and instrumental methods of chemical analysis.

CE-220L Environmental Chemistry Laboratory

Credits: 1

Co-requisite(s): CE-220

Course Type(s): MEBP

Soil, aquatic and atmospheric chemistry; environmental analytical chemistry; connections to environmental biology. Sources, reactions, mobility, effects and fates of chemical species in the soil, water and air environments and the effect of human activity on these. Laboratory experiments and field trips will be used to address the needs for this course. Students will gain hands-on experience in both classical and instrumental methods of chemical analysis.

- CE-221 Analytical Chemistry I Quantitative Analysis** Credits: 3
Prerequisite(s): CE-112 and CE-112L both passed with a grade of C- or higher
Co-requisite(s): CE-221L
Term Offered: Spring Term
Course Type(s): None
Theoretical principles and techniques of volumetric, gravimetric, and potentiometric methods of analysis; treatment of analytical data, equilibria involving acid-base, redox, complexometric, and precipitation reactions.
- CE-221L Analytical Chemistry I Laboratory Quantitative Analysis** Credits: 1
Co-requisite(s): CE-221
Term Offered: Spring Term
Course Type(s): None
Laboratory techniques, procedures, and practice in quantitative analysis of selected substances by volumetric, gravimetric, and potentiometric methods.
- CE-241 Organic Chemistry I** Credits: 3
Prerequisite(s): CE-112 and CE-112L both passed with a grade of C- or higher
Co-requisite(s): CE-241L
Term Offered: All Terms
Course Type(s): None
Preparations and reactions of major classes of organic compounds with extensive discussion of reaction mechanisms and stereo-chemistry; interpretation of mass, infrared, and nuclear magnetic resonance spectra.
- CE-241L Organic Chemistry I Laboratory** Credits: 1
Prerequisite(s): CE-112 and CE-112L.
Co-requisite(s): CE-241
Term Offered: All Terms
Course Type(s): None
Laboratory work demonstrating the basic techniques of organic chemistry; qualitative organic analysis; and use of the gas chromatograph and infrared and nuclear magnetic resonance spectrometers to solve problems. Three hours per week.
- CE-242 Organic Chemistry II** Credits: 3
Prerequisite(s): CE-241 and CE-241L, both passed with a grade of C- or higher.
Co-requisite(s): CE-242L.
Term Offered: All Terms
Course Type(s): MEBP
Preparations and reactions of major classes of organic compounds with extensive discussion of reaction mechanisms and stereo-chemistry; interpretation of mass, infrared, and nuclear magnetic resonance spectra.
- CE-242L Organic Chemistry II Laboratory** Credits: 1
Prerequisite(s): CE-241 and CE-241L, both passed with a grade of C- or higher.
Co-requisite(s): CE-242.
Course Type(s): None
Laboratory work demonstrating the basic techniques of organic chemistry; qualitative organic analysis; and use of the gas chromatograph and infrared and nuclear magnetic resonance spectrometers to solve problems. Three hours per week.
- CE-298 Special Topics in Chemistry (200 Level)** Credits: 1-3
Prerequisite(s): CE-111, CE-111L, CE-112, CE-112L and others as announced in the course schedule
Course Type(s): None
An intensive study of a particular subject or problem in chemistry to be announced prior to registration. May be conducted in a lecture, seminar or laboratory format.
- CE-299 Independent Study in Chemistry** Credits: 1-3
Term Offered: Spring Term
Course Type(s): None
Original research work planned and carried out with the assistance of a faculty research advisor. The number of course credits will be arranged with the advisor. Three hours per credit. Prior permission of the directing professor and department chair is required to take this course.
- CE-314 Chemical Literature and Seminar** Credits: 3
Prerequisite(s): CE-241
Term Offered: All Terms
Course Type(s): RD
The course focuses on the professional development of chemistry majors including: the chemical literature and how to use it, presentation skills for chemists, laboratory safety, professional ethics, and intellectual property.
Prerequisite: CE-241
- CE-322 Analytical Chemistry II** Credits: 3
Prerequisite(s): CE-221, CE-221L, MA-116, PH-212, and PH-212L, all passed with a grade of C- or higher, or permission of the instructor.
Term Offered: Fall Term
Course Type(s): None
Basic components of instruments and their arrangements; fundamental principles, applications, and limitations of instrumental methods of chemical analysis; spectroscopic methods (UV-Visible, Fourier transform infrared, Raman, Fluorescence, Phosphorescence, Atomic absorption, Atomic emission, and Mass spectrometry); electrochemical methods (Potentiometry and Voltammetry); separation methods (High Performance liquid chromatography, Gas chromatography, and Capillary Electrophoresis).
- CE-322L Analytical Chemistry II Laboratory** Credits: 2
Co-requisite(s): CE-322
Term Offered: Fall Term
Course Type(s): WT
Basic components of instruments and their arrangements; fundamental principles, applications and limitations of instrumental methods of chemical analysis; spectroscopic methods (UV-Visible, Fourier transform infrared, Fluorescence, Atomic absorption and Atomic emission); electrochemical methods (Potentiometry and Voltammetry); separation methods (High Performance liquid chromatography, Gas chromatography - Mass spectrometry). Laboratory experiments and an independent research project will be used to address the needs of this course. Students will gain hands-on experience in instrumental methods of chemical analysis for both qualitative and quantitative work.
- CE-325 NMR Spectroscopy** Credits: 3
Prerequisite(s): CE-242L
Term Offered: Fall Term
Course Type(s): None
A treatment of the theories and applications of modern Fourier transform nuclear magnetic resonance (FT-NMR) spectroscopy. Applications of FT-NMR spectroscopy to the investigation and solution of chemical problems will be emphasized.

CE-333 Biochemistry

Prerequisite(s): CE-242
 Co-requisite(s): CE-333L
 Term Offered: Fall Term
 Course Type(s): None

Biochemistry is a field about chemistry in living organisms. Biochemistry CE-333 is a 1-semester complete biochemistry course. This water-based chemistry will initially explore monomers (amino acids, monosaccharides and nucleotides) followed by their polymers (protein, polysaccharides and nucleic acids) with a focus on the relationship between their structure and function. Moreover, structures and properties of fatty acids to phospholipids and membranes will be studied. The properties of these molecules and how they all interact together will be further studied through the concepts of enzymology and metabolism. Being multidisciplinary, this course should be taken by chemistry majors, as well as students aiming at graduate school or medical professional fields. Prerequisite: CE-242 Corequisite: CE-333L

Credits: 3 CE-374 Industrial Chemistry

Prerequisite(s): CE-242
 Term Offered: Fall Term
 Course Type(s): None

A treatment of some reaction chemistry, chemical processes, thermodynamics, chemical equilibria, and kinetics that are important to the chemical industry. Fundamental principles and problems of the chemical industry will also be discussed.

Credits: 3**CE-333L Biochemistry Laboratory**

Term Offered: Fall Term
 Course Type(s): WT
 CE-333L will provide training in modern biochemical techniques, using proteins, nucleic acids, carbohydrates and lipids. This laboratory will provide students with hands-on experience in basic and modern techniques commonly used in biochemistry, that will be required in the pursuit of their academic and career objectives. Prerequisites: EN-101 and EN-102 Corequisite: CE-333

Credits: 1**CE-350 Research in Chemistry**

Term Offered: All Terms
 Course Type(s): EX5
 Original research work, carried out under the mentorship of a faculty research advisor. Research conducted by the students may be submitted for presentation, publication, or review, as appropriate. The number of course credits will be determined by arrangement with the advisor. Three hours/week per credit, 1-3 credits. Prerequisites: Determined by faculty mentor.

Credits: 1-4**CE-360 Biophysical Chemistry**

Prerequisite(s): CE-242
 Term Offered: All Terms
 Course Type(s): None
 Principles and applications of physical chemistry including thermodynamics, kinetics and spectroscopy to study the structure and function of biological macromolecules. Prerequisite: CE-242

Credits: 3**CE-360L Biophysical Chemistry Laboratory**

Prerequisite(s): CE-242
 Term Offered: All Terms
 Course Type(s): None
 The Lab course is designed to give hands-on experience with contemporary experimental instrumentation and techniques that are widely used in the biophysical characterization of biological macromolecules. Students will also work on individual projects designed to provide a real-life academic/industrial research experience and will submit a clear and concise report and presentation based on the experimental results. Prerequisite: CE-242 Corequisite: CE-360

Credits: 1**CE-381 Physical Chemistry I**

Prerequisite(s): MA-116, PH-212, both passed with a grade of C- or higher.
 Co-requisite(s): CE-381L.
 Term Offered: Fall Term
 Course Type(s): None

Credits: 3

Basic principles of quantum mechanics essential for understanding of atomic and molecular spectroscopy are covered. The specific topics included: Quantum Mechanics: postulates and formulation of Schrodinger equation, uncertainty principle, particle in a box, simple harmonic oscillator, rigid rotor, Hydrogen atom, hydrogenic wave functions, Pauli principle, Helium atom, Hydrogen molecule, Molecular Orbital Theory; Introduction and applications of Computational Chemistry; Spectroscopy; Light-matter interaction, term symbols, spectroscopic selection rules, electronic spectra of atoms and molecules, rotational and vibrational spectra, IR and Raman spectroscopy, Lasers.

CE-381L Physical Chemistry I Laboratory

Prerequisite(s): EN-101 and EN-102 or permission of the instructor.
 Co-requisite(s): CE-381.

Credits: 1

Term Offered: Fall Term

Course Type(s): WT
 This course is designed to be taken concurrently with CE-381, Physical Chemistry I. The experiments performed complement material studied in CE-381. Topics covered include: UV-Vis, FT-IR, Raman, Laser Induced Fluorescence, and Flash Photolysis spectroscopies. This laboratory also requires the use of modern computer platforms and quantum chemistry software for molecular simulations and data analysis.

CE-382 Physical Chemistry II

Prerequisite(s): MA-116, PH-212 and CE-381, all passed with a grade of C- or higher
 Co-requisite(s): CE-382L
 Term Offered: All Terms
 Course Type(s): None

Credits: 3

Amplification of concepts in thermodynamics, chemical kinetics and dynamics and application of these to gases, liquids, and solutions to provide a solid background for understanding the physical principles that govern behavior of chemical and biological systems. The specific topics included: Thermodynamics: standard functions (enthalpy, entropy, etc.), ensembles, partition function. Gibbs chemical potential, phase equilibria, electrochemical cells; Kinetic Theory of Gases: Maxwell-Boltzmann distribution, collision frequency; effusion rate, heat capacity, transport processes (diffusion, viscosity, etc.); Chemical Kinetics: differential and integral expressions for rate laws, reaction mechanisms, Chemical Dynamics: collision theory, absolute rate theory, transition state theory. Corequisite: CE-382L

- CE-382L Physical Chemistry II Laboratory** **Credits: 1**
 Prerequisite(s): EN-101 and EN-102 or permission of the instructor.
 Co-requisite(s): CE-382.
 Term Offered: Spring Term
 Course Type(s): WT
 This course is designed to be taken concurrently with CE-382, Physical Chemistry I. The experiments performed complement material studied in CE-382. Topics covered include experimental investigation of gas laws, phase transitions, transport properties of gases (diffusion), electrochemistry (electrolysis, electroplating, and voltammetry) and chemical kinetics (fluorescence quenching). This laboratory also requires the use of modern computer platforms and quantum chemistry software for simulations of chemical kinetics, dynamics and data analysis.
- CE-388 Cooperative Education: Chemistry** **Credits: 1-3**
 Prerequisite(s): CE-221, CE-221L, CE-242, and CE-242L; an overall G.P.A. of 2.00; fifteen credits completed at Monmouth University, and approval of the Department of Chemistry
 Term Offered: Spring Term
 Course Type(s): EX2
 Application of chemical concepts and skills learned in lecture and laboratory to work-related experiences. Students and faculty sponsors maintain journals of their cooperative education opportunities with the assistance of the Director of Cooperative Education. Students will work forty hours per credit per semester at their jobs. Students will maintain journals of their cooperative education experiences and write reports demonstrating how their experiences helped them achieve their learning goals. This is a pass/fail course. Departmental approval is required to take this course.
- CE-389 Internship in Chemistry** **Credits: 1-3**
 Prerequisite(s): CE-221, CE-221L, CE-242, CE-242L, an overall GPA of 2.00, fifteen credits completed at Monmouth University, and approval by the Department of Chemistry
 Term Offered: All Terms
 Course Type(s): EX1
 Provides an opportunity to apply chemical concepts and skills learned in lecture and laboratory to work-related experiences. Students and faculty sponsors will identify internship opportunities. Students will work forty hours per credit per semester in their internship positions. Students will maintain journals of their internship experiences and write reports demonstrating how their internship experiences helped them achieve the learning objectives identified at the start of the internships. This is a pass/fail course.
- CE-398 Special Topics in Chemistry (300 Level)** **Credits: 1-3**
 Prerequisite(s): CE-241, CE-241L, CE-242, CE-242L, or as announced in the course schedule
 Term Offered: Spring Term
 Course Type(s): None
 An intensive study of a particular subject or problem in chemistry to be announced prior to registration. May be conducted in a lecture, seminar, or laboratory format.
- CE-398L Special Topics in Chemistry** **Credits: 3**
 Course Type(s): None
 An intensive study of a particular subject or problem in chemistry to be announced prior to registration. Conducted in a laboratory format.
- CE-399 Independent Study in Chemistry (300 Level)** **Credits: 1-3**
 Term Offered: All Terms
 Course Type(s): None
 Original research work planned and carried out with the assistance of a faculty research advisor. The number of credits will be arranged with the advisor. Prior permission of the directing professor and department chair is required to take this course.
- CE-401 Advanced Inorganic Chemistry** **Credits: 3**
 Prerequisite(s): CE-242 and CE-242L both passed with a grade of C- or higher
 Term Offered: All Terms
 Course Type(s): None
 Modern theories of inorganic chemistry, including advanced considerations of atomic and molecular structure, chemical bonding, complex ions, solid state chemistry, magnetic properties of ions, periodicity, and contemporary problems.
- CE-401L Advanced Inorganic Chemistry Laboratory** **Credits: 1**
 Co-requisite(s): CE-401
 Term Offered: All Terms
 Course Type(s): None
 Inorganic synthetic techniques, including inert atmosphere, high temperature, and non-aqueous solvents; methods of characterization of inorganic compounds, including use of spectroscopic and other instrumental methods. Three hours per week.
- CE-405 Methods of Inorganic Chemistry** **Credits: 3**
 Prerequisite(s): CE-401
 Term Offered: Spring Term
 Course Type(s): None
 Coverage of important experimental methods in inorganic structural determinations. Topics include symmetry and group theory, computational methods, mass spectrometry, diffraction analysis and nuclear magnetic resonance, electron paramagnetic resonance, rotational, Mossbauer, vibrational, electronic absorption, photoelectron spectroscopies. The application of these techniques to the characterization and determination of inorganic substances is the emphasis of the course.
- CE-432 Advanced Analytical Chemistry** **Credits: 3**
 Prerequisite(s): CE-322 passed with a grade of C- or higher.
 Term Offered: All Terms
 Course Type(s): None
 This course examines modern analytical techniques with special emphasis on gas chromatography (GC), liquid chromatography (LC) and capillary electrophoresis (CE) in terms of basic principles, instrumentation, method development and practical applications. Mass spectrometry (MS) and ion mobility spectrometry (IMS) are also extensively explored as detection techniques for GC (GC-MS and GC-IMS), LC (LC-MS), and CE (CE-MS). Multidimensional separations (LC x LC & GC x GC) and their practical applications are also examined. A combination of traditional lecture notes, textbook readings and published peer-reviewed scientific literature will be used to explore and discuss topics. The course also involves case studies on analytical method development, data interpretation and applications of analytical techniques covered as well as visits to or tours of facilities with sophisticated analytical instrumentation relevant to the course.
- CE-452 Advanced Organic Chemistry** **Credits: 3**
 Prerequisite(s): CE-242 and CE-242L both passed with a grade of C- or higher
 Term Offered: Spring Term
 Course Type(s): None
 Selected topics of modern, theoretical, organic chemistry.

CE-454 Advanced Biochemistry**Credits: 3**

Prerequisite(s): CE-333

Term Offered: Spring Term

Course Type(s): None

Advanced Biochemistry provides a deeper focus on the biochemistry of several diseases as well as medical biochemistry while building upon the concepts learned in the prerequisite biochemistry course (CE-333). Using current publications to support content, topics such as gene therapy, various blood test works will be discussed. Topics of the biochemistry of Cancer, AIDS and Aging will also be covered.

CE-460 Electrochemical Methods**Credits: 3**

Co-requisite(s): CE-341

Term Offered: Spring Term

Course Type(s): None

Theory and applications of electrochemical analysis: electrode processes, thermodynamics and kinetics of electrode reactions, controlled potential and controlled current microelectrode techniques, and bulk electrolysis.

CE-475 Computational Chemistry and Molecular Modeling**Credits: 3**

Prerequisite(s): CE-341 and CE-341L both passed with a grade of C- or higher

Term Offered: Spring Term

Course Type(s): None

Principal methods and techniques used to study organic molecules and biomolecules by computational methods. Interpretation of chemical data with the aid of a computer. Atomic and molecular orbitals, force fields, molecular dynamics, and molecular modeling and drug design.

CE-484 Methods Development and Statistical Process Control**Credits: 4**

Prerequisite(s): CE-432 and MA-151 both passed with a grade of C- or higher.

Term Offered: All Terms

Course Type(s): None

Concentrates on methods development in the analytical laboratory with applications in pharmaceutical, food product, cosmetics, and environmental testing. This course focuses on methods development and optimization to satisfy regulatory and customer requirements, validating analytical methods, application of newer analytical methods, and those involved in quality control, quality assurance, and quality assessment. Discusses regulatory framework and requirements including FDA, WHO, and ICH examples. Focus includes development and use of statistical process control as tools to improve quality and productivity.

CE-486 Medicinal Chemistry**Credits: 3**

Prerequisite(s): CE-241 and CE-242

Term Offered: Spring Term

Course Type(s): None

A Medicinal Chemistry course in which you will learn about the application of chemistry to the discovery, design and synthesis of new drugs. Medicinal chemistry is an interdisciplinary science. Its successful application to new drug discovery and development involves knowledge of organic chemistry, biology, physiology, microbiology, biochemistry, pharmacology and medicine among others. Topics that will be covered in this course include: structure and function of biological targets (proteins, enzymes, receptors and DNA/RNA); sources of new drugs from nature or synthesis; methods used to identify relevant structural features for biological activity; fate of a drug in the body and interaction with its biological target (pharmacokinetics and pharmacodynamics); strategies for drug design and case studies.

CE-489 Internship in Chemistry**Credits: 1-3**

Prerequisite(s): CE-221, CE-221L, CE-242, CE-242L, an overall GPA of 2.00, fifteen credits completed at Monmouth University, and approval by the Department of Chemistry

Term Offered: Spring Term

Course Type(s): EX1

Provides an opportunity to apply chemical concepts and skills learned in lecture and laboratory to work-related experiences. Students and faculty sponsors will identify internship opportunities. Students will work forty hours per credit per semester in their internship positions. Students will maintain journals of their internship experiences and write reports demonstrating how their internship experiences helped them achieve the learning objectives identified at the start of the internships. This is a pass/fail course.

CE-498 Special Topics in Chemistry (400 Level)**Credits: 1-3**

Prerequisite(s): CE-242 or as announced in the course schedule

Term Offered: Spring Term

Course Type(s): None

An intensive study of a particular subject or problem in chemistry to be announced prior to registration. May be conducted in a lecture, seminar, or laboratory format.

CE-499 Independent Study in Chemistry**Credits: 1-3**

Term Offered: All Terms

Course Type(s): None

Original research work planned and carried out with the assistance of a faculty research advisor. The number of course credits will be arranged with the advisor. Three hours per credit. Prior permission of the directing professor and department chair is required to take this course.

CE-499T Independent Study in Chemistry**Credits: 3**

Term Offered: All Terms

Course Type(s): None

Original research work planned and carried out with the assistance of a faculty research advisor. Prior permission of the directing professor and department chair is required to take this course.