

CHEMISTRY (CCHE)

CCHE 111 Gen Chem 1 & Recitation 4 Credits

This is the introductory course in college chemistry. The topics covered in this course include: stoichiometry, atomic structure, molecular structure and bonding and gas laws. Three [3] hours of lecture, three [3] hours of laboratory and three [3] hours of recitation are required.

CCHE 111H Honors Gen Chem & Recitation 4 Credits

CCHE 111: Fundamental theories and laws, chemical calculations, equations, periodic classification of the elements, structure of matter, and ionization. CCHE 112: Study of chemical and ionic equilibria, nuclear chemistry, chemistry of the metallic elements, and elementary qualitative analysis of cations and anions. Three (3) lecture hours and six (6) laboratory hours per week.

CCHE 111HL Honors General Chemistry Lab 0 Credits

Lab - CCHE 111: Fundamental theories and laws, chemical calculations, equations, periodic classification of the elements, structure of matter, and ionization. CCHE 112: Study of chemical and ionic equilibria, nuclear chemistry, chemistry of the metallic elements, and elementary qualitative analysis of cations and anions. Three (3) lecture hours and six (6) laboratory hours per week.

CCHE 111L General Chemistry Lab 0 Credits

This is the introductory course in college chemistry. The topics covered in this course include: stoichiometry, atomic structure, molecular structure and bonding and gas laws. Three [3] hours of lecture, three [3] hours of laboratory and three [3] hours of recitation are required.

CCHE 112 Gen Chem II Lec & Recitation 4 Credits

The topics covered in this course include: kinetics, equilibria, thermodynamics, and electrochemistry. Three [3] hours of lecture, three [3] hours of laboratory and three [3] hours of recitation are required. Prerequisite: CCHE 111.

CCHE 112H General Honors Chemistry 4 Credits

This is the continuation of Chemistry 111. The topics covered in this course include: kinetics, equilibria, thermodynamics, and electrochemistry. Three [3] hours of lecture, three [3] hours of laboratory and three [3] hours of recitation are required. Prerequisite: CCHE 111.

CCHE 112HL Honors General Chemistry Lab 0 Credits

Lab - This is the continuation of Chemistry 111. The topics covered in this course include: kinetics, equilibria, thermodynamics, and electrochemistry. Three [3] hours of lecture, three [3] hours of laboratory and three [3] hours of recitation are required. Prerequisite: CCHE 111.

CCHE 112L General Chemistry II Lab 0 Credits

The topics covered in this course include: kinetics, equilibria, thermodynamics, and electrochemistry. Three [3] hours of lecture, three [3] hours of laboratory and three [3] hours of recitation are required. Prerequisite: CCHE 111.

CCHE 211 Analytical Chemistry I 4 Credits

Study of homogeneous and heterogeneous equilibria to include principles related to ionization, solubility, complex ions and molecules, oxidation and reduction in solution, redox potentials, electrochemical cells, and quantitative volumetric and gravimetric analysis. (Three [3] lecture hours and six [6] laboratory hours per week are required.) Prerequisites: CCHE 112/112L.

CCHE 211L Analytical Chemistry Lab 0 Credits

Study of homogeneous and heterogeneous equilibria to include principles related to ionization, solubility, complex ions and molecules, oxidation and reduction in solution, redox potentials, electrochemical cells, and quantitative volumetric and gravimetric analysis. (Three [3] lecture hours and six [6] laboratory hours per week are required.) Prerequisites: CCHE 112/112L.

CCHE 231 Organic Chemistry 4 Credits

This is an introduction of the chemistry of carbon. The topics covered include: bonding, molecular structure, reaction mechanisms and spectroscopy. Studies are the properties of aliphatic and aromatic compounds. (Three [3] lecture hours, three [3] laboratory hours and one and one-half [1.5] recitation hours per week are required.) Prerequisites: CCHE 112/112L/112R.

CCHE 231L Organic Chemistry Lab 0 Credits

This is an introduction of the chemistry of carbon. The topics covered include: bonding, molecular structure, reaction mechanisms and spectroscopy. Studies are the properties of aliphatic and aromatic compounds. (Three [3] lecture hours, three [3] laboratory hours and one and one-half [1.5] recitation hours per week are required.) Prerequisites: CCHE 112/112L/112R.

CCHE 231R Organic Chemistry Recitation 0 Credits

This is an introduction of the chemistry of carbon. The topics covered include: bonding, molecular structure, reaction mechanisms and spectroscopy. Studies are the properties of aliphatic and aromatic compounds. (Three [3] lecture hours, three [3] laboratory hours and one and one-half [1.5] recitation hours per week are required.) Prerequisites: CCHE 112/112L/112R.

CCHE 231WE Organic Chemistry 4 Credits

This is an introduction of the chemistry of carbon. The topics covered include: bonding, molecular structure, reaction mechanisms and spectroscopy. Studies are the properties of aliphatic and aromatic compounds. Three (3) lecture hours, three (3) laboratory hours and one and one-half (1.5) recitation hours per week are required. Prerequisites: CCHE 112/112L/112R.

CCHE 232 Organic Chemistry 4 Credits

This is a continuation of CCHE 231. The topics covered include: bonding, molecular structure, reaction mechanisms and spectroscopy. Studies are the properties of aliphatic and aromatic compounds which include proteins, carbohydrates, drugs and biomolecules. Three [3] lecture hours, three [3] laboratory hours, and one and one-half (1.5) recitation hours per week are required. Prerequisites: CCHE 231/231L/231R.

CCHE 232L Organic Chemistry Lab 0 Credits

This is a continuation of CCHE 231. The topics covered include: bonding, molecular structure, reaction mechanisms and spectroscopy. Studies are the properties of aliphatic and aromatic compounds which include proteins, carbohydrates, drugs and biomolecules. Three [3] lecture hours, three [3] laboratory hours, and one and one-half (1.5) recitation hours per week are required. Prerequisites: CCHE 231/231L/231R.

CCHE 232R Organic Chemistry Recitation 0 Credits

This is a continuation of CCHE 231. The topics covered include: bonding, molecular structure, reaction mechanisms and spectroscopy. Studies are the properties of aliphatic and aromatic compounds which include proteins, carbohydrates, drugs and biomolecules. Three [3] lecture hours, three [3] laboratory hours, and one and one-half (1.5) recitation hours per week are required. Prerequisites: CCHE 231/231L/231R.

CCHE 232WE Organic Chemistry 4 Credits

This is a continuation of CCHE 231. The topics covered include: bonding, molecular structure, reaction mechanisms and spectroscopy. Studies are the properties of aliphatic and aromatic compounds which include proteins, carbohydrates, drugs and biomolecules. Three (3) lecture hours, three (3) laboratory hours, and one and one-half (1.5) recitation hours per week are required. Prerequisites: CCHE 231/231L/231R.

CCHE 341 Physical Chemistry I 3 Credits

The study of the laws and theories of chemical phenomena, including elementary thermodynamics, the gaseous, liquid, and solid state, equilibria, and chemical kinetics (rates of chemical reactions, and kinetics of complex reactions, and some molecular reaction dynamics). (Three [3] lecture hours per week.) Prerequisites: CCHE 211/211L; CPHY 111/111L and CPHY 112/112L; CMAT 111, CMAT 112, CMAT 211, and CMAT 212.

CCHE 341L Physical Chemistry Lab 1 Credit

Laboratory investigations in physical chemistry. Experiments carried out include coverage of five major areas of physical chemistry: thermodynamics, spectroscopy, kinetics, quantum mechanics, and statistical mechanics. (Four [4] laboratory/recitation hours per week are required.)

CCHE 341R Physical Chemistry Recitation 0 Credits

Laboratory investigations in physical chemistry. Experiments carried out include coverage of five major areas of physical chemistry: thermodynamics, spectroscopy, kinetics, quantum mechanics, and statistical mechanics. (Four [4] laboratory/recitation hours per week are required.)

CCHE 342 Physical Chemistry II 3 Credits

Elementary quantum mechanics, molecular reaction dynamics activated complex theory and dynamics of molecular collisions and the application of elementary quantum mechanics to atomic and molecular structure and spectroscopy. (Three [3] lecture hours per week). Prerequisites: CCHE 211/211L; CPHY 111/111L and CPHY 112/112L; CMAT 111, CMAT 112, CMAT 211, and CMAT 212.

CCHE 342L Physical Chemistry Lab 1 Credit

Laboratory investigations in physical chemistry. Experiments carried out include coverage of five major areas of physical chemistry: thermodynamics, spectroscopy, kinetics, quantum mechanics, and statistical mechanics. (Four [4] laboratory/recitation hours per week are required.)

CCHE 381 Chemistry Seminar 0 Credits

This is a one-hour lecture/seminar course. CCHE 381 Zero (0) credit. CCHE382 One (1) credit. One year of the course generates one credit.

CCHE 382 Chemistry Seminar 1 Credit

This is a one-hour lecture/seminar course. CCHE 381, Zero (0) credits. CCHE382, One (1) credit. One year of the course generates one credit.

CCHE 400 Undergraduate Research 1-3 Credits

This course provides academic credit for the student pursuing an undergraduate graduate degree in chemistry or related fields and who carry out laboratory or other research supervised by a chemistry faculty member.

CCHE 412 Instrumental Methods 3 Credits

A lecture and laboratory course covering the theory, design, practical uses and applications of typical spectroscopic and chromatographic instrumentation. Particular focus is on the application of the instrumentation for chemical analysis. (Three [3] lecture hours and six [6] laboratory hours per week are required.). This course is numbered CCHE 512 for graduate students and is three (3) credits. Prerequisites: CCHE 211/211L, CCHE 341/341L/341R, and CCHE 342/342L/342R.

CCHE 412L Instrumentation Lab 1 Credit

A lecture and laboratory course covering the theory, design, practical uses and applications of typical spectroscopic and chromatographic instrumentation. Particular focus is on the application of the instrumentation for chemical analysis. (Three [3] lecture hours and six [6] laboratory hours per week are required.). This course is numbered CCHE 512 for graduate students and is three (3) credits. Prerequisites: CCHE 211/211L, CCHE 341/341L/341R, and CCHE 342/342L/342R.

CCHE 421 Advanced Inorganic Chemistry 3 Credits

This is an introduction to the descriptive chemistry of the elements. The topics covered in this course include: Brønsted and Lewis acids and bases, electronic and molecular structure and coordination chemistry. (Three [3] lecture hours with laboratory each week are required.). Prerequisites: CCHE 341/341L/341R, and CCHE 342/342L/342R.

CCHE 431 Advanced Organic Chemistry 3 Credits

This course is a study of the advanced topics in carbon chemistry. The topics covered include: Critical evaluation of modern organic theory mechanisms and rearrangements. It also includes a detailed study of important organic reactions and their application to selected laboratory experiments. (Three [3] lecture hours and one [1] laboratory hour per week are required.) Prerequisites: CCHE 231/231L/231R and CCHE 232/232L/232R.

CCHE 431L Advanced Organic Chemistry Lab 1 Credit

Lab - This course is a study of the advanced topics in carbon chemistry. The topics covered include: Critical evaluation of modern organic theory mechanisms and rearrangements. It also includes a detailed study of important organic reactions and their application to selected laboratory experiments. (Three [3] lecture hours and one [1] laboratory hour per week are required.) Prerequisites: CCHE 231 and 232.

CCHE 432 Methods of Structure Determin 3 Credits

This course covers the theory and techniques used in the determination of the structure of organic compounds. The topics covered include separation techniques as well as the use of UV/VIS, IR, NMR, ESR, Raman and mass spectroscopy to elucidate structures of organic compounds. (Three [3] lecture hours and one [1] laboratory hour per week are required.) Prerequisite: CCHE 431/431L.

CCHE 432L Methods of Structural Det Lab 1 Credit

Lab - This course covers the theory and techniques used in the determination of the structure of organic compounds. The topics covered include separation techniques as well as the use of UV/VIS, IR, NMR, ESR, Raman and mass spectroscopy to elucidate structures of organic compounds. (Three [3] lecture hours and one [1] laboratory hour per week are required.) Prerequisite: CCHE 431.

CCHE 441 Mathematical Methods in Chemis 3 Credits

A study of the mathematical methods used in physical chemistry, including applications of linear algebra and differential equations. (Three [3] lecture hours per week). Prerequisites: CCHE 341/341L/341R and CCHE 342/342L/342R.

CCHE 445 Intro to Comp Chem Mol. Model 4 Credits

This course provides an introduction to some of the techniques used in computational chemistry and molecular modeling and demonstrates how these techniques can be used to study physical, chemical and biological phenomena. Prerequisites: CCHE 111 & 112; CBIO 111 & 112 CCHE 231 & 232; CMAT 111.

CCHE 445L Intro to Computational Chem La 0 Credits**CCHE 448 Intro. to Material Science 3 Credits**

This course is intended to be an introductory course in materials science. The course topics include aspects of processing, structure, properties, and performance of materials with regard to the design, production, and utilization of materials. The goal is to introduce the fundamental concepts in chemistry and atomic structure of materials that determine the function. The course is designed to provide an overview of several classes of materials including metals, ceramics, polymers, and composites; as well as an understanding of relationships that exist between the structures and properties of materials. The course will discuss mechanical, electrical, thermal, magnetic, and optical properties of materials that determine their applicability. Students will be assigned activities that relate the role of materials with modern applications. Students will work on a term-report to analyze objects or devices that use materials creatively.

CCHE 449 Techni-Materials Characterizat 3 Credits

the Materials Characterization course is a hands-on introductory course on

CCHE 450 X-Ray Diff and Thermal Anal Ma 3 Credits**CCHE 480 Special Topics in Chemistry 4 Credits**

Detailed study of a series of advanced topics in any area of chemistry. Students undertake independent projects. (Three [3] lecture hours per week with required laboratory)

CCHE 480L Special Topics in Chem Lab 0 Credits

LAB for Detailed study of a series of advanced topics in any area of chemistry. Students undertake independent projects. (Three [3] lecture hours per week with required laboratory)

CCHE 480WE Special Topics in Chemistry 4 Credits

Detailed study of a series of advanced topics in any area of chemistry. Students undertake independent projects. (Three [3] lecture hours per week with required laboratory)

CCHE 481 Chemistry Seminar 0 Credits

This is a one-hour lecture/seminar course. One year of the course generates one hour of credit. Prerequisites: CCHE 481 zero (0) credit, CCHE 482 one (1) credit.

CCHE 482 Chemistry Seminar 1 Credit

This is a one-hour lecture/seminar course. One year of the course generates one hour of credit. CCHE 481 zero (0) credit, CCHE 482 one (1) credit

CCHE 508 Seminar in Chemistry 1 Credit

This is a one-hour lecture/seminar course. One year (two semesters) of the course generates one hour of credit. Required of all graduate students.

CCHE 511 Environmental Chemistry 3 Credits

An examination of the origins, transport, reactions, effects, ultimate fate of hazardous waste in the environment. This course is designed to develop a working level knowledge of: (1) chemistry fundamentals; and (2) the basic principles and concepts of environmental chemistry: including (a) geochemistry; (b) atmospheric chemistry; (c) environmental microbiology; and (d) waste treatment. (Three [3] lecture hours per week)

CCHE 512 Instrumental Methods 3 Credits

A lecture and laboratory course covering the theory, design, practical uses and applications of typical spectroscopic and chromatographic instrumentation. Particular focus will be on the application of the instrumentation for chemical analysis.

CCHE 512L Instrumental Methods Lab 1 Credit

A lecture and laboratory course covering the theory, design, practical uses and applications of typical spectroscopic and chromatographic instrumentation. Particular focus will be on the application of the instrumentation for chemical analysis.

CCHE 521 Advanced Inorganic Chemistry 3 Credits

Treatment of bonding and structure, oxidation-reduction and acid-base theory, and correlation with chemical reactivity, and Ligand field theory. (Three [3] lecture hours per week)

CCHE 531 Mechanistic Organic Chem I 3 Credits

Treatment of bonding, resonance, inductive and steric effects and discussion reactive intermediates, nucleophilic substitution and elimination reactions a mechanistic point of view. (Three [3] lecture hours per week)

CCHE 532 Organic Synthesis 3 Credits

The chemistry of aromatic, heterocyclic and alicyclic compounds with emphasis on mechanisms. This course will teach students the disconnection approach for the synthesis of complex organic molecules. The course will present modern methods for carbon-carbon bond formation and apply these methods to prepare target molecules. (Three [3] lecture hours per week)

CCHE 533 Physical Organic Chemistry 3 Credits

Molecular orbital calculations, frontier molecular orbital theory and organic reaction mechanisms, stereochemistry of organic molecules containing centers, planes and axes of chirality. (Three [3] lecture hours per week)

CCHE 541 Thermodynamics 3 Credits

A rigorous treatment of basic theories and methods in chemical thermodynamics and equilibria including phase equilibria, chemical reactions, real solutions, surface effects, and some applications to macromolecules. (Three [3] lecture hours per week)

CCHE 542 Quantum Mechanics 3 Credits

Concepts and general principles of wave mechanics, with mathematical discussion of the hydrogen atom and harmonic oscillator. Introduction to matrix mechanics, angular momentum operators, and applications to small molecules. Variational and perturbation techniques are discussed. (Three [3] lecture hours per week)

CCHE 544 Molecular Spectroscopy 3 Credits

Introduction and discussion of the fundamentals of rotational, vibrational, Raman, and electronic spectra. Development of the quantum mechanical treatment of these phenomena. (Three [3] lecture hours per week)

CCHE 548 Material Science 3 Credits

CCHE 549 Techn.Materials Characterizati 3 Credits

The Materials Science Laboratory course is a hands-on introductory course to different instrumental techniques for Materials Characterization. Each laboratory module is designed to enable students to get requisite practical experience with various concepts developed in the lecture course. Additionally, the students will become familiar with common instruments used for materials characterization like the scanning electron microscope (SEM), atomic force microscope (AFM), x-ray diffraction (XRD), Raman, UV/V is NMR, DLS and FTIR spectrometers as well gel permeation chromatography (GPC), thermo-gravimetric analyzer (TGA) and differential scanning calorimeter (DSC), among others.

CCHE 550 X-Ray Diffraction and Thermal Analysis of Materials 3 Credits

Course Format and Philosophy: Module 1 of the course is designed to give an introduction of theory and techniques of X-Ray diffraction and their applications to materials science. Module 2 will give an introduction to the theory and practice of thermomechanical analysis of materials. Module 3 will focus on how FT NMR works and how to optimize data acquisition and processing. Prerequisites: CMAT 111, CMAT 112, CCHE 231, CCHE232

CCHE 551 Advanced Biochemistry I 3 Credits

A study of the chemistry of carbohydrates, lipids, proteins, enzymes, and other compounds of biological significance and their applications to biological systems, enzyme kinetics. (Three [3] lecture hours per week)

CCHE 552 Advanced Biochemistry II 3 Credits

Bioenergetics of metabolic reactions, metabolism of carbohydrates, lipids, proteins, nucleotides. An intensive study of protein synthesis, membrane transport and biochemical genetics. (Three [3] lecture hours per week)

CCHE 571 Intro to Polymer Chemistry 3 Credits

Synthesis, including radical and ionic polymerization and polycondens reactions, structure-property relationships, characterization and rheological properties of polymeric materials.

CCHE 572 Techniques in Polymer Chem 3 Credits

A course designed to introduce students to experimental polymer chemistry, synthesis using ionic, free-radical and condensation polymerizations, molecular weight measurements by viscosity, osmometry, gel permeation and light scattering, spectroscopic characterization of polymers, measurements of thermal transitions. (Two [2] lecture hours and two [2] laboratory hours per week)

CCHE 621 Topics in Inorganic Chemistry 3 Credits

In-depth treatment of areas of inorganic chemistry of current interest. (Three [3] lecture hours per week.)

CCHE 637 Adv Topic in Organic Chemistry 3 Credits**CCHE 674 Topics in Polymer Chemistry 3 Credits**

Course addresses current trends and topics of interest in polymer sciences. may include polymerization mechanism, polymer blends and composites, polymer spectroscopy, engineering properties of polymer, chemistry of mate polymer processing, etc., materials, polymer processing, etc. (Three [3] lecture hours per week)

CCHE 700 Thesis Consultation 1-3 Credits**CCHE 710 Research in Analytical Chem 1-9 Credits****CCHE 720 Research in Inorganic Chem 1-9 Credits****CCHE 730 Research in Organic Chemistry 1-9 Credits****CCHE 740 Research in Physical Chemistry 1-9 Credits****CCHE 750 Research in Biochemistry 1-6 Credits****CCHE 760 Research in Industrial Chem 1-6 Credits****CCHE 770 Research in Polymer Chemistry 1-9 Credits****CCHE 790 External Research 1-6 Credits****CCHE 901 Dissertation Consultation 1 Credit**