

## Undergraduate Courses Description

CHEM 131 (3) **Introduction to Chemistry.** Co-Requisite Mathematics 004 or higher. A study of scientific measurements, mathematic concepts, and basic principles of chemistry to prepare students for General Chemistry (CHEM 141) classes. (F, S)

CHEM 141 (3) **General Chemistry I.** Prerequisite: A score of 30 or above on the Chemistry Placement Test (Toledo Test), passing grade of “C” or higher on CHEM 131, or MATH 111, or a higher level mathematics course. The important topics to be covered are measurements of length, mass, volume, density, temperature and conversion of units; classification of matter into elements, compounds, and mixtures, concepts of atomic theory, naming and representing ions, molecules and compounds, qualitative and quantitative aspects of chemical reactions (moles, stoichiometry, percent yield etc.), atomic structure, periodicity, chemical bonding and enthalpy changes of chemical reactions. (F, S, Sum)

CHML 141 (1) **General Chemistry Lab.** Co-requisite: CHEM 141. Experiments in the areas covered in CHEM 141. (F, S, Sum)

CHEM 142 (3) **General Chemistry II.** Prerequisite: CHEM 141 and CHML 141. The course covers properties of gases, liquids and solids, chemical kinetics, chemical equilibrium, reactivity of acids and bases, solubility and solubility product, second and third law of thermodynamics, and electrochemistry. (F, S, Sum)

CHML 142 (1) **General Chemistry II Lab.** Co-requisite: CHEM 142. Laboratory experiments in the areas covered in CHEM 142. (F, S, Sum)

CHEM 241 (3) **Organic Chemistry I.** Prerequisite: CHEM 142 and CHML 142. Chemistry of carbon compounds, with emphasis on the nature of organic compounds, their structures, bonding and molecular properties; chemical reactivity including mechanism and application of organic reaction in organic synthesis; structural analysis of organic compounds including spectroscopy (F, S, Sum)

CHML 241 (1) **Organic Chemistry I Lab.** Prerequisites: CHEM 142, CHML 142. Co-Requisite: CHEM 241. Laboratory experiments in the areas covered by CHEM 241. (F, S, Sum)

CHEM 242 (3) **Organic Chemistry II.** Prerequisite: CHEM 241, CHML 241. Chemistry of carbon compounds, with emphasis on classes of organic compounds and their reactions and synthesis, and an introduction to biochemistry. (F, S, Sum)

CHML 242 (1) **Organic Chemistry II Lab.** Prerequisites: CHEM 241, CHML 241. Co-requisite: CHEM 242. Laboratory experiments in the areas covered by CHEM 242. (F, S, Sum)

CHEM 243 (3) **Qualitative Organic Analysis.** Prerequisites: CHEM 241, CHML 241, Co-requisite: CHEM 242, CHML 242, 243. A lecture covering the structure identification of organic compounds by spectroscopic methods. It includes theory and application of spectroscopies: NMR, IR, UV/Vis and Mass Spectroscopy. (S)

CHML 243 (1) **Qualitative Organic Analysis Lab.** Prerequisites: CHEM 241, CHML 241; Co-requisites: CHEM 242, 243; Experiments using NMR, IR, UV/Vis and Mass Spectroscopy to elucidate structure of organic compounds. (S)

CHEM 254 (3) **Elementary Quantitative Analysis**. Prerequisites: CHEM 142 and CHML 142. A study of the theory and applications of analytical chemistry. This is a lecture course primarily intended for students preparing for careers in the health sciences.

CHML 254 (1) **Quantitative Analysis Lab**. Co-requisite: CHEM 254. Laboratory experiments in the areas covered by CHEM 254.

CHEM 310 (2) **Introduction to Scientific Research**. Prerequisite: Consent by advisors. The course serves as an introduction to scientific research for students entering a research area. The course covers scientific literature, scientific writing, scientific presentation, research ethics, and introduction to federal agencies (NSF, NIH, DoD, etc.) and their research focuses, trends, and funding opportunities.

CHEM 320 (3) **Analytical Chemistry**. Prerequisite: CHEM 142, CHML 142, and CHEM 241. A quantitative study of the equilibrium in aqueous and non-aqueous systems and application to analytical methods. The application of modern instrumentals techniques is emphasized. (F)

CHML 320 (1) **Analytical Chemistry Lab**. Co-requisite: CHEM 320. Laboratory experiments in the areas covered by CHEM 320.

CHEM 331 (3) **Introduction to Biochemistry**. Prerequisite: CHEM 242. A survey of the chemical composition of living matter and the chemical reactions of living cells. (F)

CHEM 340 (2) **Inorganic Chemistry I**. Prerequisites: CHEM 142 and CHML 142. The course covers molecular structure, properties, and reactions of inorganic compounds with an emphasis on bonding theory, molecular symmetry and its relationship to spectra, solid-state, reaction mechanisms, *d*-metal complexes, coordination chemistry, descriptive chemistry of selected elements, electronic spectra of complexes, organometallic reactions and catalysis. (S)

CHEM 341 (3) **Physical Chemistry I**. Prerequisite: CHEM 242, MATH 241, 242; co-requisite or prerequisite: PHY 201 or 211. A study of fundamental concepts; includes structure, properties of gases and thermodynamics. (F)

CHML 341 (1) **Physical Chemistry I Lab**. Co-requisite: CHEM 341. Laboratory experiments on physical chemistry phenomena. (F)

CHEM 342 (3) **Physical Chemistry II**. Prerequisite: CHEM 341 and CHML 341. A study of physical chemistry, theory and practice; includes structure of matter, quantum mechanics, electrochemistry and kinetics. (S)

CHML 342 (1) **Physical Chemistry II Lab**. Prerequisite: CHEM 341; Co-requisite: CHEM 342. Laboratory experiments on Physical Chemistry phenomena. (S)

CHEM 350 (Variable 1-3) **Special Topics**. Prerequisite: Permission of instructor. A specialized topic course covering recent developments in chemistry selected on the basis of faculty and student interest and needs. (F)

CHEM 371 (3) **Forensic Chemistry**. Pre-requisite: CHEM 320. Co-requisite: CHML 371. This course covers the major forensic sub-disciplines such as firearms and tool mark examination, forensic biology, arson and explosives, questioned documents, and trace evidence. Evidence categories include glass, soil, hairs, fibers, paint (surface coating), and impressions resulting from friction ridge skin, tools, foot wear, etc. (S)

CHML 371 (1) **Forensic Chemistry Lab.** Co-Requisite: CHEM 371. This course covers the theory and practice of techniques commonly used in forensic science including examination of biological evidence (DNA fingerprinting, bloodstains, etc.), fingerprinting, and impressions resulting from friction ridge skin, tools, foot wear, etc. (S)

CHEM 380 (Variable 1-6) **Independent Study.** Prerequisite: Permission of instructor. Laboratory investigation of a research topic selected by the advisor in consultation with the student. (F, S, Sum)

CHEM 381, 382, 481, 482 (0.5, 0.5, 0.5, 0.5) **Chemistry Seminar.** Prerequisite: Permission of instructor. Presentation and discussion of current chemistry research topics visiting speakers, faculty, staff and students. (F, S)

CHEM 401 (3) **Chemistry in the Secondary School.** A course designed to treat the principles, problems, and materials involved in teaching chemistry on the secondary level. (F)

CHEM 410 (3) **Environmental Chemistry.** Prerequisite: CHEM 242 and CHEM 320. Environmental Chemistry is to study sources, reactions, transport, effects, and fates of chemical species in water, soil, air, and living environments, and the effects of technology therein. This course will cover three major areas of environmental chemistry: aquatic chemistry, atmospheric chemistry, and geochemistry. Each one includes organic, inorganic, analytical chemistry and biochemistry for pollutants in the environment, their fates, and analysis. The objectives in the course are to understand how environmental system will behave for the chemical species and to learn how to analyze the pollutants in the system. (F)

CHML 410 (1) **Environmental Chemistry Laboratory.** Co-requisite: CHEM 410. This course is the laboratory course of CHEM 410 Environmental Chemistry. Laboratory experiments are designed to illustrate the topics in the lecture and acquaint students with laboratory techniques in environmental chemistry. (F)

CHEM 421 (3) **Instrumentation.** Prerequisite: CHEM 320, CHML 320 or permission of the instructor. The course covers theory and applications of spectroscopic, chromatographic and electroanalytical methods. Emphasis is placed on principles, possibilities and limitations inherent in various methods available to today's chemists. Lectures will concentrate on theoretical background of many instrumental techniques and their applications, while the laboratories will provide opportunities to learn practical aspects of instrumental techniques through a series of "hands-on" projects. (S)

CHML 421 (1) **Instrumentation Lab.** Prerequisite: CHEM 320, CHML 320; co-requisite: CHEM 421. A laboratory course covering the use of spectroscopic, chromatographic, and electrochemical instrumentation for analysis of materials.

CHEM 431 (3) **Biochemistry I.** Prerequisite: CHEM 242. A study of the chemical composition of living matter and the chemical mechanics of life processes. It covers four main types of biological macromolecules (proteins, nucleic acids, carbohydrates, and lipids), enzyme kinetics, and metabolism of glucose. (S)

CHML 431 (1) **Biochemistry I Lab.** Co-requisite: CHEM 431. Basic purification and characterization techniques in biochemistry. (S)

CHEM 432 (3) **Biochemistry II.** Prerequisite: CHEM 431. A study of the chemical composition of living matter and the chemical mechanics of life processes. (F)

CHML 432 (1) **Biochemistry II Lab.** Co-requisite: CHEM 432. Basic purification and characterization techniques in biochemistry. (F)

CHEM 436 (3) **Physical Organic Chemistry**. Prerequisite: CHEM 342. Structure, bonding, and properties of organic compounds.

CHEM 437 (2) **Organic Synthesis**. Prerequisite: CHEM 242. The use of practical organic research techniques in the preparation of organic compounds. (S)

CHEM 441 (3) **Inorganic Chemistry II**. Prerequisite: CHEM 340. An in-depth discussion of atomic properties, nature of chemical bonds, and symmetry properties of compounds will be discussed built upon the first part of inorganic chemistry and the following topics will be included: chemistry and application of transition metals, mechanisms of catalysis processes, and function of inorganic elements in living systems. (F)

CHML 441 (1) **Advanced Inorganic Lab**. Co-requisite: CHEM 441. Theoretical principles and laboratory techniques involved in the preparation and the characterization of inorganic compounds. (F)

CHEM 451 (3) **Chemical Application of Group Theory**. Prerequisite: CHEM 341. A course which places emphasis on the application of group theory to interpretation of the electronic and molecular spectra of molecules. An elementary treatment of abstract mathematical group theory is presented to serve as an introduction to the symmetry of point groups to which most molecular systems belongs. (S)

CHEM 452 (3) **Atomic and Molecular Structure**. Prerequisite: CHEM 342. An introduction to the concepts and methods of modern molecular spectroscopy. (S)

CHEM 453 (3) **Thermodynamics**. Prerequisite: CHEM 342. Principles of thermodynamics and their application to chemical and phase equilibria. (S)

CHEM 458 (3) **Quantum Mechanics**. Prerequisite: CHEM 342. Principles and applications of quantum theory. (F)

CHEM 471 (3) **Forensic Toxicology**. Pre-Requisites: CHEM 320 and CHEM 371. This course covers the major concepts of toxicology that include drug or toxin absorption, distribution, and excretion as well as binding to receptors. The processes and reactions, which transform a drug or toxin into a water soluble substance, also will be discussed. (S)

CHEM 475 (3) **Forensic Practicum**. Prerequisite: Departmental approval and CHEM 371 and CHML 371. Students will have an internship at a local or regional crime laboratory to satisfy the practice component of the program and spend a minimum of 8 hours per week at the laboratory for 14 weeks. (S)