CHEMISTRY (CHEM)

CHEM 101 | CHEMISTRY AND SOCIETY
Units: 3 Repeatability: No
A course designed for the non-science major that focuses on the major ideas of modern chemistry and the role that chemistry plays in a technological society. The evolution of our understanding of atomic and molecular structure and chemical reactivity will be examined as examples of the scientific method and the very human nature of the scientific endeavor. The role of modern chemistry in both the creation and the solution of societal problems will also receive considerable attention. The problems examined, which may vary in different sections, include: the energy crisis, air and water pollution, global warming, nutrition and food additives, household chemicals, pesticides and agrochemicals, and nuclear power. Two lectures weekly.

CHEM 102 | SCIENCE OF FOOD & COOKING
Units: 3 Repeatability: No
Core Attributes: Science/Tech Inquiry area
Non-Core Attributes: Lab
Course Description: This course is designed for the non-science major with a focus on food, cooking and baking while introducing foundational concepts in chemistry and biochemistry. Using a variety of approaches including hands-on activities, students will learn the chemical and biochemical principles of food and cooking. Students will investigate the molecular structure and changes that take place in food and drink while cooking and baking. Topics may include: making cheese and ice cream, spices and hot sauces, caramelization and food browning reactions, molecular gastronomy, taste and smell, cakes and cookies and chocolate. Students will participate in inquiry-based laboratories integrated throughout the semester while designing and performing scientific experiments to investigate the nature of food and cooking. Two hours of lecture per week and one four hour lab every other week. No prerequisites.

CHEM 103 | DNA SCIENCE AND TECHNOLOGY
Units: 3 Repeatability: No
A course designed for the non-science major that covers basic physical science concepts and how they apply to the discovery and study of DNA as the genetic material, the simplicity of the three-dimensional structure of DNA and the many implications to be drawn from this structure. It explores the concepts involved in recombinant DNA technology and its applications to the pharmaceutical industry, agriculture, forensics, gene therapy and AIDS research. Two lectures weekly.

CHEM 105 | PHYSICAL SCIENCES FOR K-8 TEACHERS
Units: 3 Repeatability: No
Core Attributes: Science/Tech Inquiry area
Non-Core Attributes: Lab
A laboratory/lecture/discussion class designed to lead students toward an understanding of selected topics in chemistry and physics. The course topics are selected to satisfy the physical science specifications of the science content standards for California Public Schools (K-12). Enrollment is limited to liberal studies majors. Two two-hour class meetings per week. Fall semester. This course is cross-listed with PHYS 105.

CHEM 111 | CHEMISTRY AND SOCIETY
Units: 3 Repeatability: No
Core Attributes: Science/Tech Inquiry area
Non-Core Attributes: Lab
A course designed for the non-science major that focuses on the major ideas of modern chemistry and the role that chemistry plays in a technological society. The evolution of our understanding of atomic and molecular structure and chemical reactivity will be examined as examples of the scientific method and the very human nature of the scientific endeavor. The role of modern chemistry in both the creation and the solution of societal problems will also receive considerable attention. The problems examined, which may vary in different sections, include: the energy crisis, air and water pollution, global warming, nutrition and food additives, household chemicals, pesticides and agrochemicals, and nuclear power. This course includes a laboratory that will satisfy the Core requirement for Science and Technology Inquiry. Two hours of lecture per week and one four hour lab every other week.

CHEM 112 | SCIENCE VS. WICKED PROBLEMS
Units: 3 Repeatability: No
Core Attributes: Science/Tech Inquiry area
Non-Core Attributes: Lab
Science vs. Wicked Problems focuses on the chemistry of the challenges and problems that face a sustainable thriving environment. This course will fulfil the USD Core requirements for Exploration in Science and Technology Inquiry (ESTI). Science vs. Wicked Problems is a topics coursed designed for the non-science major with a focus on the chemistry approach to understanding sustainability, green chemistry, and chemical causes and solutions of climate change while introducing foundational concepts in chemistry from a molecular prospective. No prior knowledge of chemistry is assumed. Using a variety of active-learning approaches including hands-on activities, students will learn the principles of chemical environmental sustainability and how they relate to chemistry, social justice, and resource limitations. Students will investigate the molecular changes that take place in the production of energy, food and commercial goods, and transportation. Topics may include: making green chemistry approaches of synthesis and waste, other re-use /recycling strategies, minimizing greenhouse gas emissions, making water safe to drink, avoiding air pollution, and eco-development options. Students will participate in inquiry-based laboratories integrated throughout the semester while designing and performing scientific experiments to investigate how to transform the way we live into something more sustainable. Two hours of lecture per week and one four hour lab every other week.

CHEM 113 | APPLICATIONS OF SCIENCE AND TECHNOLOGY IN OUR EVERYDAY WORLD
Units: 3 Repeatability: No
Core Attributes: Science/Tech Inquiry area
Non-Core Attributes: Lab
This course will fulfil the USD Core requirements for Exploration in Science and Technology Inquiry (ESTI). Applications of Science and Technology in Our World is a topics course offering a chance to study a variety of modern approaches involving chemistry in our modern world. No prior knowledge of chemistry is needed for this course. Topics include a range of interesting ways chemistry impacts our modern world: Chemistry of Art and Color, Chemistry in Sports, Biochemistry of Drugs and Medicine, Science of Toxicology, Chemistry of Beer and others. Each course will integrate hands-on laboratory experiences where students will interpret modern question in chemistry, conduct inquiry-based laboratories, and design experiments to teach the scientific method, learn the approaches of chemistry in our everyday world and investigate the important and interesting aspects of each topics course.

CHEM 151 | GENERAL CHEMISTRY I
Units: 3-4 Repeatability: No
Core Attributes: Science/Tech Inquiry area
Prerequisites: (MATH 115 or MATH 130 or MATH 150 or MATH 151 or Passing the appropriate departmental placement test within the previous year or Passing the appropriate departmental placement test within the previous year or Passing the appropriate departmental placement test within the previous year) and CHEM 151L (Can be taken Concurrently)
Part 1 of a two semester lecture course which introduces the fundamental principles of modern chemistry. These principles, which include atomic and molecular structure, periodicity, reactivity, stoichiometry, equilibrium, kinetics, thermodynamics, bonding, acid-base chemistry, redox chemistry, and states of matter, will be used in and expanded upon in more advanced courses. Three lectures weekly.

CHEM 151L | GENERAL CHEMISTRY I LABORATORY
Units: 1 Repeatability: No
Core Attributes: Quantitative reasoning comp, Science/Tech Inquiry area
Non-Core Attributes: Lab
Prerequisites: MATH 115 or MATH 130 or MATH 150 or MATH 151 or Passing the appropriate departmental placement test within the previous year or Passing the appropriate departmental placement test within the previous year or Passing the appropriate departmental placement test within the previous year
Part 1 of a two-semester laboratory course which introduces the concepts and techniques of experimental chemistry. CHEM 151L has one laboratory period that meets biweekly.

CHEM 152 | GENERAL CHEMISTRY II
Units: 3 Repeatability: No
Core Attributes: First Yr Integration (LC Only)
Prerequisites: CHEM 151 and CHEM 151L and CHEM 152L (Can be taken Concurrently)
Part 2 of a two semester lecture course which introduces the fundamental principles of modern chemistry. These principles, which include atomic and molecular structure, periodicity, reactivity, stoichiometry, equilibrium, kinetics, thermodynamics, bonding, acid-base chemistry, redox chemistry, and states of matter, will be used in and expanded upon in more advanced courses. Three lectures weekly.

CHEM 152L | GENERAL CHEMISTRY II LABORATORY
Units: 1 Repeatability: No
Non-Core Attributes: Lab
Prerequisites: CHEM 151 and CHEM 151L
Part 2 of a two-semester laboratory course which introduces the concepts and techniques of experimental chemistry. One laboratory period weekly.

CHEM 220 | ANALYTICAL CHEMISTRY
Units: 3 Repeatability: No
Prerequisites: CHEM 152 and CHEM 152L
An introduction to the principles and practices of analytical chemistry with an emphasis on quantitative methods. Classical methods such as titrimetric and volumetric analyses as well as basic instrumental methods involving spectroscopy, electrochemistry, and chromatography will be performed. Some experiments will be of the project type. One laboratory and one lecture weekly.

CHEM 294 | SPECIAL TOPICS IN CHEMISTRY/BIOCHEMISTRY
Units: 0.5-4 Repeatability: Yes (Repeatable if topic differs)
Rotating courses with various chemical and biochemical topics. Can be repeated for credit when topic changes.

CHEM 296 | INTRODUCTION TO UNDERGRADUATE RESEARCH
Units: 1-2
Collaborative student-faculty research in the research laboratory of a faculty member in the Department of Chemistry and Biochemistry. The course is taught on a pass/fail basis only.

CHEM 301 | ORGANIC CHEMISTRY I
Units: 3 Repeatability: No
Prerequisites: CHEM 152 and CHEM 152L and CHEM 301L (Can be taken Concurrently)
Part 1 of a two semester introduction to basic organic chemistry. The relationship of structure and bonding in organic compounds to reactivity will be emphasized. Reactions will be discussed from mechanistic and synthetic perspectives. Three lectures weekly.

CHEM 301L | ORGANIC CHEMISTRY I LABORATORY
Units: 1 Repeatability: No
Non-Core Attributes: Lab
Prerequisites: CHEM 152 and CHEM 152L
This lab is the first semester of a two-semester sequence. It introduces common organic lab techniques (including chromatography, extraction, recrystallization, distillation) used for separating and analyzing organic compounds. One laboratory period weekly.

CHEM 302 | ORGANIC CHEMISTRY II
Units: 3 Repeatability: No
Prerequisites: CHEM 301 and CHEM 301L and CHEM 302L (Can be taken Concurrently)
Part 2 of a two semester introduction to basic organic chemistry. The relationship of structure and bonding in organic compounds to reactivity will be emphasized. Reactions will be discussed from mechanistic and synthetic perspectives. Three lectures weekly.

CHEM 302L | ORGANIC CHEMISTRY II LABORATORY
Units: 1 Repeatability: No
Non-Core Attributes: Lab
Prerequisites: CHEM 301 and CHEM 301L
This lab is the second semester of a two-semester sequence. Common organic lab techniques and spectroscopy are used to carry out and analyze multi-step organic syntheses. One laboratory period weekly.

CHEM 311 | PHYSICAL CHEMISTRY I
Units: 3 Repeatability: No
Prerequisites: CHEM 152 and MATH 151 and PHYS 270 and PHYS 271 (Can be taken Concurrently)
This course covers modern physical chemistry, including atomic and molecular structure, and spectroscopy. Three lectures weekly. Fall semester.

CHEM 312 | PHYSICAL CHEMISTRY II
Units: 3 Repeatability: No
Prerequisites: CHEM 152 and MATH 151 and PHYS 270 and PHYS 271 (Can be taken Concurrently)
This course focuses on the classical principles of thermodynamics, kinetics, and statistical mechanics. Three lectures weekly. Spring semester.

CHEM 330 | TECHNIQUES IN MOLECULAR BIOLOGY
Units: 3 Repeatability: No
Prerequisites: BIOL 242 and BIOL 242L
An introduction to recombinant DNA techniques including bacterial culture, transformation, nucleic acid purification, restriction analysis, DNA cloning, polymerase chain reaction, etc. Computer-based sequence analyses include database accession, BLAST, alignments, restriction analysis, gene-finding, and genomics. A cloning project generating new molecular reagents will be undertaken. One lecture and one laboratory weekly. Completion of CHEM 301 and CHEM301L is recommended.

CHEM 331 | BIOCHEMISTRY
Units: 3
Prerequisites: CHEM 302 and CHEM 302L
The structure, function, and metabolism of biomolecules. Structure and function of proteins, carbohydrates, lipids, nucleic acids, and important accessory molecules (cofactors and metal ions) are covered, as well as enzyme kinetics and mechanism, thermodynamics, metabolism, and the regulation of metabolism. Three lectures weekly.

CHEM 332 | BIOCHEMISTRY II
Units: 3 Repeatability: No
Prerequisites: CHEM 331
This course advances the fundamental concepts of macromolecules, structure/function paradigms, enzyme mechanism & activity and metabolism gained in CHEM 331. We will study metabolic homeostasis, integrating anabolic/catabolic pathways and energy flux with nutrition/nutrient intake of essential and non-essential molecules. Regulatory control through allosteric, transcriptional/translational, and post-translational mechanisms will be examined as part of maintaining metabolic homeostasis. Where relevant, disease and pathology will be used to highlight these concepts. We will study signal transduction to address the flow of information within a system. As a capstone to our indepth study of biochemistry, we will examine cross-disciplinary applications of core biochemical concepts (structure/function, homeostasis, energy flow and information flow) in the context of systems biology, chemical biology and synthetic biology.

CHEM 355 | ENVIRONMENTAL CHEMISTRY
Units: 3 Repeatability: No
Prerequisites: CHEM 152 and CHEM 152L
A survey of the natural environment from a chemist's point of view and the evaluation of chemicals from an environmental point of view. This course is concerned with the chemistry of air, water, soil and the biosphere in both pristine and polluted states. Pollution prevention and mitigation schemes are considered. Lab experiments include local fieldwork. One lecture and one laboratory weekly. Every other spring semester.

CHEM 356 | WATER QUALITY AND PUBLIC HEALTH IN THE DEVELOPING WORLD
Units: 3 Repeatability: No
Core Attributes: Global Diversity level 1
Non-Core Attributes: International
Prerequisites: CHEM 152 and CHEM 152L
An immersive experience where we will explore water quality issues in the developing world, and the impact of these issues on public health. This course will be primarily offered in the January Intersession or during the summer, because we will travel to a developing country and conduct water quality analyses and explore the water quality issues that impact the local public and community health. Students in the class, in partnership with students from the country of interest, will have lectures, field exercises, and laboratory experiences that will help them understand how water quality monitoring is carried out. Additionally, students will have lectures from local experts that include historical, cultural, societal, and economic influences on the state of water access, water quality, and public health in the country of interest.

CHEM 396 | METHODS OF CHEMICAL RESEARCH
Units: 1.5 Repeatability: No
Core Attributes: Advanced Integration
Prerequisites: (CHEM 152 with a minimum grade of C- and CHEM 152L with a minimum grade of C-)
Introduction to the principles, methods, and communication of chemical and biochemical research. Techniques for searching the chemical literature, research ethics integrity and professional development are included. One 80 minute lecture per week. Every semester.

CHEM 422 | PHYSICAL METHODS
Units: 4 Repeatability: No
Core Attributes: Advanced writing competency
Non-Core Attributes: Lab
Prerequisites: CHEM 220 and CHEM 302 and CHEM 302L and CHEM 311 (Can be taken Concurrently)
An advanced laboratory course which probes concepts in physical chemistry using instrumental techniques including spectroscopy, chromatography and microscopy. Modern topics in physical chemistry, new technology in instrumentation, and computational data analysis will be integral parts of the laboratory in addition to some classical experiments and methods. Fall semester.

CHEM 424 | ADVANCED SYNTHESIS LABORATORY
Units: 4 Repeatability: No
Non-Core Attributes: Lab
Prerequisites: CHEM 220 and CHEM 302 and CHEM 302L and CHEM 440 (Can be taken Concurrently)
An advanced laboratory course which integrates theory and experimental techniques from organic and inorganic chemistry. The course will focus on advanced topics of organic and inorganic chemistry (such as bioinorganic chemistry and organic materials) that are not included in CHEM 301, 301L, 302, 302L and 440. Emphasis will be placed on applications to the sub-fields of organic and inorganic chemistry. Two lectures and two laboratory periods weekly. Spring semester.

CHEM 427 | BIOPHYSICAL CHEMISTRY
Units: 4 Repeatability: No
Prerequisites: CHEM 331
This is an advanced lecture and laboratory course applying fundamental theories of physical chemistry in the context of thermodynamic, kinetic and quantum chemistry to understand the behavior of biological molecules and systems. Topics and experiments include spectroscopy, kinetics, thermodynamic of macromolecules, structure and function of protein, lipids, RNA and DNA as well as multimeric complex systems. Every other spring semester.

CHEM 435 | BIOCHEMISTRY LABORATORY
Units: 4 Repeatability: No
Core Attributes: Advanced writing competency
Non-Core Attributes: Lab
Prerequisites: CHEM 330 or BIOL 330
An advanced laboratory course that focuses on techniques for the preparation and quantitative analysis of proteins, DNA and other biomolecules. Experiments will include preparation of buffers, production and purification of proteins, and analysis of protein structure and function. Two laboratory periods weekly.

CHEM 440 | INORGANIC CHEMISTRY
Units: 3 Repeatability: No
Prerequisites: CHEM 302
The principles of inorganic chemistry, such as atomic and molecular structure, bonding, acid-base theory, and crystal field theory, are examined. Utilizing these principles, the chemistry of the elements of the periodic table is discussed, including the kinetics and mechanisms of reactions. The various fields within inorganic chemistry, including solid-state, coordination and organometallic chemistry are introduced. Three lectures weekly. Fall semester.

CHEM 489 | MAJOR FIELD TEST IN CHEMISTRY
Units: 0
As a part of the department's assessment program, each graduating senior is required to take the major field test in chemistry. A student who fails to take the major field test may be restricted from graduating. Every year.

CHEM 494 | SPECIAL TOPICS IN CHEMISTRY/BIOCHEMISTRY
Units: 1-4 Repeatability: Yes (Repeatable if topic differs)
Rotating in-depth courses focused on various chemical and biochemical topics based primarily on the expertise of faculty. Repeatability: Yes (Can be repeated for credit when topic changes.) Prereq: Varied.

CHEM 496 | UNDERGRADUATE RESEARCH
Units: 0.5-3 Repeatability: Yes (Can be repeated for Credit)
Non-Core Attributes: Experiential
Collaborative student-faculty research in the research laboratory of a faculty member in the Department of Chemistry and Biochemistry. The course is taught on a pass/fail basis only. Prereq: Approval by department chair.

CHEM 496H | HONORS UNDERGRADUATE RESEARCH
Units: 1-3 Repeatability: Yes (Can be repeated for Credit)
Non-Core Attributes: Experiential, Honors
Collaborative student-faculty research in the research laboratory of a faculty member in the Department of Chemistry and Biochemistry. The course is taught on a pass/fail basis only.

CHEM 498 | RESEARCH INTERNSHIP
Units: 1-2 Repeatability: Yes (Can be repeated for Credit)
Non-Core Attributes: Experiential
Prerequisites: CHEM 151 and CHEM 151L
This course offers experience in the practical and experimental application of chemical or biochemical principles. Students will be involved in research projects conducted by agencies and institutions outside the University, such as chemical/biochemical, pharmaceutical and biotechnology industries. Enrollment is arranged on an individual basis according to a student’s interest and background, and is dependent on positions available and faculty approval.