CHEMISTRY

http://www.pacific.edu/Academics/Schools-and-Colleges/College-of-the-Pacific/Academics/Departments-and-Programs/Chemistry.html
Phone: (209) 946-2271
Location: Classroom Building, Room 174
Jianhua Ren and Jerry Tsai, Co-Chairs

Programs Offered

Master of Science in Pharmaceutical and Chemical Sciences
Doctor of Philosophy in Pharmaceutical and Chemical Sciences

Specialized Areas in Chemistry (2): 1) Bioanalytical/Physical Chemistry and Biochemistry and 2) Chemical Synthesis and Drug Design/Discovery

For detailed program information for these degrees please consult the Thomas J. Long School of Pharmacy (https://www.pacific.edu/academics/schools-and-colleges/thomas-j-long-school-of-pharmacy/academics/pharmaceutical-and-chemical-sciences.html) section in this catalog.

Chemistry Courses

CHEM 121. Organic Chemistry. 5 Units.
An Introduction to the fundamental principles of organic chemistry including molecular structure, chemical bonding, functional groups, nomenclature, stereochemistry, basic organic reactions, and modern spectroscopy for structural characterization. Three lecture periods and two three-hour laboratory periods per week are required. Prerequisites: CHEM 025 and CHEM 027 with a "C-" or better.

CHEM 122. Applied Organic Chemistry I. 4 Units.
Applied Organic Chemistry I is an introduction to the fundamental principles of organic chemistry, including molecular structure, chemical bonding, functional groups, nomenclature, stereochemistry, basic organic reactions, and modern spectroscopy for structural characterization. It is a foundation of pharmaceutical science, biochemistry, nanotechnology, and material science, etc. It is intended for pre-health students. The lecture will highlight the key information of organic chemistry and will provide materials that complement and exceed the textbook. Three lecture periods and one three-hour laboratory period per week are required. Prerequisites: Both CHEM 026 and CHEM 028 with a "C" or better, or both CHEM 025 and CHEM 027 with a "C-" or better. Enrollment is limited to undergraduates in the Pre-Pharmacy Advantage Program.

CHEM 123. Organic Chemistry. 5 Units.
This course is a continuation of CHEM 121 with an emphasis on organic synthesis and mechanisms. The reactions of the aromatics, aldehydes, ketones, amines, carboxylic acids and their derivatives, and carbohydrates are covered. The course also touches on polymers and biological molecules including amino acids, proteins, and nucleic acids. Three lecture periods and two three-hour laboratory periods per week and are required. Prerequisite: CHEM 121 with a "C-" or better.

CHEM 124. Applied Organic Chemistry II. 4 Units.
Applied Organic Chemistry II is a continuation of Applied Organic Chemistry I with an emphasis on organic synthesis and mechanisms. The reactions of aromatics, aldehydes, ketones, amines, carboxylic acids and their derivatives, and carbohydrates are covered. The course also touches on polymers and biological molecules including amino acids, proteins, and nucleic acids. Three lecture periods and one three-hour laboratory periods per week are required. Prerequisites: CHEM 122 with "C" or better, or CHEM 121 with “C“ or better. Enrollment is limited to undergraduates in the Pre-Pharmacy Advantage Program.

CHEM 132. Teaching and Learning Chemistry. 2 Units.
Students are prepared for participation in peer-led team-learning (PLTL) models of instruction in this course and it provides the opportunity for the students to become student leaders. In the PLTL, or General Chemistry Workshops, a small group of students get together under the guidance of the trained student leaders and work through a set of challenging problems prepared by the instructor of the course. The main idea is for all the students in the group to work together and gain experience and confidence solving challenging problems as a group. The Workshop provides an active teaching and learning experience. This course can be taken multiple times. Prerequisites: CHEM 025 and CHEM 027 with a "B" or better and permission of the instructor.

CHEM 134. Teaching and Learning Organic Chemistry. 2 Units.
Student are introduced to the learning and leadership model, Peer-Led Team Learning (PLTL). The student will gain hands-on experience in leading small discussion groups in organic chemistry. Instructor-covered topics in organic chemistry include specific instructions regarding the workshop lessons, strategies in guided problem solving for the groups, and review of organic chemistry materials. Instructor-covered topics in the didactic portion of the course include, but are not limited to, practical information (understanding motivation, managing time, dealing with dominating students, learning styles, group dynamics, study skills, helping students improve critical thinking, develop logical reasoning, and prepare for tests), and a foundation in learning theory. Prerequisites: CHEM 025 and CHEM 027 with "C-" or better, CHEM 121 and CHEM 123 with "B" or better and permission of instructor.

CHEM 141. Analytical Chemistry. 4 Units.
The roots of analytical chemistry and the principles used in modern instruments come from traditional techniques. These techniques include gravimetry, acid-base, complexometric, and redox titrations form the backbone of the course, which covers most major areas of modern quantitative analysis. The theory behind the techniques is covered through many numerical examples and their applications in environmental and biochemical analyses are emphasized. Standard procedures used in analytical laboratories are introduced, including error reporting, statistics, and quality assurance. Prerequisites: CHEM 025 and CHEM 027 or GEOS 142 with a "C-" or better.

CHEM 143. Instrumental Analysis Lab. 4 Units.
Advanced analytical methodology involving electronic instrumentation is offered with emphasis on practical application and "hands-on" experience. The theory of instrumental operation is covered. Examples from modern spectroscopy, mass spectrometry, NMR, chromatography and other methods of analysis are included. Prerequisite: CHEM 141 with a "C-" or better or permission of the instructor.

CHEM 151. Biochemistry I. 4 Units.
This is the first semester of a 2 semester survey of biochemistry. The fundamental building blocks of biochemical systems are introduced covering amino acids and proteins (enzymatic & structural), nucleic acids, lipids and membranes, and carbohydrates. Particular topics of oxygen transport, exzyme kinetics, DNA replication, RNA expression, and protein expression are gone over in detail. Prerequisites: CHEM 121 and CHEM 123; CHEM 159 or CHEM 161 all with a "C-" or better; or permission of instructor.

CHEM 153. Biochemistry II. 3 Units.
As the second semester in this biochemistry series, the detailed biochemical mechanisms of the major metabolic pathways are covered. These pathways include glycolysis, gluconeogenesis, citric acid cycle, electron transport/oxidative phosphorylation, photosynthesis/Calvin cycle, lipid metabolism/fatty acid catabolism, and the synthesis/degradation of amino and nucleic acids. Discussion centers on the enzymatic mechanisms, energy, reduction/oxidation, control/regulation, and integration of these pathways. Prerequisite: CHEM 151 with a "C-" or better or permission of instructor.

CHEM 157. Biochemistry Laboratory. 4 Units.
Standard techniques used in Biochemistry. Exercises focus on the expression, mutation, and purification of a protein target and involves the following techniques: site-directed mutagenesis, column chromatography, electrophoresis, nucleic acid isolation and manipulation/use of relevant databases. Prerequisite: CHEM 151 or BIOL 169 with a "C-" or better; or permission of instructor.

CHEM 158. Nucleic Acid Chemistry. 4 Units.
This course surveys fundamental and advanced knowledge and current biotechnological applications in nucleic acid chemistry. Students completing this course will be able to improve critical thinking skills, oral communication, and technical writing skills. Topics related to structures of DNA and RNA, synthesis of DNA using and automated method, small molecule and nucleic acid interactions, DNA damage and repair, representative anticancer drugs, and nucleic acids used in real-life applications are discussed. Prerequisites: CHEM 121 and CHEM 123 with a grade of C- or better or instructor approval.

CHEM 159. Biophysical Chemistry. 4 Units.
This course applies the approaches and concepts of physical chemistry to describe the reactions and phenomena in biological systems. The principles of thermodynamics, kinetics, spectroscopy and transport phenomena are covered. While this is not a mathematic intensive course, the concepts require a basic knowledge of calculus. Prerequisites: MATH 051, CHEM 025, CHEM 027, PHYS 055 all with a "C-" or better or permission of instructor.

CHEM 161. Physical Chemistry -Thermodynamics and Kinetics. 4 Units.
A classical course on equilibrium thermodynamics and kinetics, including the laws of thermodynamics, the Gibbs equations, the phase rule, solutions, chemical reactions, non-ideal systems, multi-component phase equilibrium, equilibrium electrochemistry, kinetics, molecular dynamics and transport properties. Three class periods a week are required. Prerequisites: CHEM 027, MATH 053, PHYS 053 all with a "C—" or better, or permission of instructor. Students may not receive credit for both CHEM 159 and CHEM 161.

CHEM 163. Theoretical Physical Chemistry. 4 Units.
This course covers the principles of quantum theory, atomic structure and spectra, bonding, molecular spectroscopy, the foundations of statistical mechanics, the use of partition functions, the connection between statistical ensembles and thermodynamic potentials, and statistical models of gases, solids and liquids. This 4-unit course requires three 1-hour class periods and one 3-hour laboratory each week, accompanied by substantial out-of-class exercises. Prerequisites: CHEM 161 or CHEM 159, MATH 055, and PHYS 053, all with a C– or better, or permission of the instructor.

CHEM 165. Physical Chemistry III-Kinetics. 4 Units.
The fundamental principles of Chemical Kinetics are introduced in this course which covers: kinetic molecular theory of gases, rates of chemical reactions, rate laws, collision theory and chemical dynamics. Selected applications include photochemistry, catalysis, enzyme kinetics, pharmacodynamics, electrochemical systems, transport properties, viscosity, diffusion, and sedimentation. Prerequisites: CHEM 025, CHEM 027, MATH 053 or MATH 055, PHYS 053 or PHYS 055 or permission of instructor.

CHEM 167. Experimental Physical Chemistry. 4 Units.
This course introduces the principles and practice of physical chemical measurements. Techniques used in the design and construction of apparatus are discussed in lectures, and practice is provided through lab exercises and experiments. Subjects covered include kinetic theory of gases, reaction kinetics, thermodynamics, thermochemistry, and various flavors of spectroscopy. Research orientation is provided through the preparation of article manuscripts and oral presentations of results. Error analysis and statistical treatment of experimental data are emphasized. Prerequisite: CHEM 159 or CHEM 161 with a "C—" or better.

CHEM 171. Advanced Inorganic Chemistry. 4 Units.
This course includes: atomic structure, periodicity, covalent bonding theory, molecular geometry and symmetry, molecular orbital theory and its applications. Also covers coordination and organometallic chemistry, ligand field theory, spectroscopy, structure, reaction mechanisms, introduction to bioinorganic chemistry and metals in medicine. Two class periods and four hours of laboratory per week are required. Prerequisite: CHEM 163 with a "C-" or better or permission of the instructor.

CHEM 173. Enzymology. 4 Units.
The goal of this course in enzymology is to provide students with an introduction to the mechanisms used by enzymes to achieve catalysis and the methods used to study these enzyme mechanisms. This will be accomplished by reading the primary literature, creating presentations, and discussions of these papers. A secondary goal is to also understand the implementation and limitations of these methods characterizing enzyme mechanisms. Prerequisites: CHEM 123.

CHEM 181. Intro to Molecular Simulation. 4 Units.
This course enables chemistry and other science students to utilize computational tools for molecular simulation. Students who complete this class are able to understand the theory behind molecular dynamics and force-fields. In addition, students construct and execute molecular simulations using standard tools such as CHARMM, NAMD, VMD and GAUSSIAN. Students then demonstrate an ability to analyze and present the data obtained from such simulations. Prerequisites: CHEM 025 and CHEM 027 with a grade of "C-" or better and permission of instructor.

CHEM 191. Independent Study. 2-4 Units.

CHEM 193. Special Topics. 4 Units.

CHEM 195. Chemistry Department Seminars. 1 Unit.
The Department hosts a series of research seminars in which internationally recognized scientists present their latest research to an audience of Chemistry Faculty, graduate students, and Chemistry/Biochemistry undergraduate students. The selection of the speakers and the talks is designed to display a cross-section of current research trends, with talks representing each significant sub-discipline within Chemistry. Restriction on registration: Honors Students Only. Prerequisite: Permission of instructor.

CHEM 197. Independent Research. 1-4 Units.
Prerequisite: CHEM 025 with a "C-" or better.

CHEM 197D. Independent Research. 1-4 Units.

CHEM 197E. Independent Research. 1-4 Units.

CHEM 197F. Independent Research. 1-4 Units.

CHEM 197G. Independent Research. 1-4 Units.

CHEM 197H. Independent Research. 2-4 Units.

CHEM 234. Selected Topics: Organic Chemistry. 4 Units.
Topics presented at various times under this course description include physical organic, natural products and structure elucidation, stereochemistry, heterocycles and carbohydrate chemistry.

CHEM 243. Advanced Instrumental Analysis Lab. 4 Units.
Comprehensive investigation of absorption, emission, partition and electrical methods of chemical analysis. Theoretical basis and practical experience are combined in a total course. Some background in elementary optics and electronics useful but not required.

CHEM 245. Advanced Instrumental Methods. 4 Units.
Team-taught course. Students select from a number of instrumental projects, including: FTNMR, GC-mass spectrometry, advanced electrochemical techniques, high pressure liquid chromatography, photochemistry, fluorescence and phosphorescence and radioimmunoassay.

CHEM 264. Selected Topics - Physical Chemistry. 4 Units.
Topics presented at various times under this course description include: advanced thermodynamics, statistical mechanics, physical chemistry of solutions, physical methods in chemistry, photoluminescence and molecular photochemistry, and advanced kinetics. Permission of the instructor required.

CHEM 271. Advanced Inorganic/Bioinorganic Chemistry. 4 Units.
Review of basic concepts; descriptive transition metal chemistry; studies in main group and coordination chemistry; inorganic chemistry in biological systems; organometallic systems. Permission of the instructor required.

CHEM 274. Selected Topics - Inorganic Chemistry. 4 Units.
Topics presented at various times under this course description include: mechanisms of inorganic reactions, bonding theory, physical methods, nuclear chemistry and geochemistry.

CHEM 291. Independent Study. 2-4 Units.

CHEM 293. Special Topics. 3 or 4 Units.

CHEM 295. Graduate Seminar. 2 Units.

CHEM 297. Graduate Research. 1-4 Units.

CHEM 299. Thesis. 1-4 Units.

CHEM 381. Apprentice Teaching. 1-4 Units.

CHEM 391. Independent Study. 2-4 Units.

CHEM 395. Tchg. Sem. in the Clg. Chem.. 2 Units.

CHEM 397. Graduate Research. 1-6 Units.

CHEM 397A. Graduate Research. 1-4 Units.

CHEM 399. Dissertation. 1-6 Units.