

DEPARTMENT OF CHEMISTRY

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Undergraduate Courses:

CHEM 001 Introductory Chemistry [3-0-0:3]

For students with limited background in chemistry. Covers basic chemical concepts and historical development of chemistry; connections of chemistry with modern technology; its importance in economy, the environment and daily life. *Exclusion:* AL/AS Chemistry

CHEM 100 General Chemistry [3-0-0:3]

This course provides a broad background in molecular science with emphasis on relevance to contemporary issues in society, commerce and the environment. *Exclusions:* CHEM 101, CHEM 111, CHEM 131 *Prerequisite:* AL/AS Chemistry

CHEM 101 Fundamentals of Organic Chemistry [3-0-0:3]

Various classes of organic compounds, emphasizing organic chemical reactions and mechanisms and their importance in the area of biological chemistry. For non-Chemistry students who prefer to cover organic chemistry in a single semester: a concise combination of the topics of CHEM 111 and CHEM 212. *Prerequisite:* AL/AS Chemistry

CHEM 102 Physical Chemistry: Fundamentals and Applications [3-0-0:3]

Thermodynamics principles with applications to chemical equilibrium systems. *Exclusion:* CHEM 121 *Prerequisite:* AL/AS Chemistry

CHEM 111 Organic Chemistry I [3-1-0:4]

Structure and bonding; regio-, geometric, and stereoisomerism; polar and radical reactions of alkenes and alkynes; substitution and elimination reactions; and an introduction to NMR, IR, and mass spectrometry. *Exclusion:* CHEM 101 *Prerequisite:* AL Chemistry

CHEM 121 Physical Chemistry I [3-1-0:4]

Thermodynamics, chemical equilibrium electrochemistry. *Exclusion:* CHEM 102 *Prerequisite:* AL Chemistry

CHEM 131 Inorganic Chemistry I [3-1-0:4]

Bonding and structure of inorganic compounds; principles/theories that assist in understanding their behavior. *Prerequisite:* AL Chemistry

CHEM 141 Analytical Chemistry [3-0-0:3]

Fundamental and practical aspects of chemical analysis, including titrimetric, electrical and spectroscopic methods, analytical separations by GLC and HPLC. *Prerequisite:* CHEM 101 or CHEM 212

CHEM 153 Molecular Characterization Laboratory I [0-2-5:4]

Physico-chemical measurements; analysis of data for precision and accuracy; principles and techniques of thermodynamics, kinetics and electrochemistry; propagation of errors and application of computers. *Prerequisite:* CHEM 102 or CHEM 121

CHEM 154 Organic Chemistry Laboratory [0-1-3:2]

Experimental techniques of organic chemistry; preparation, separation and characterization of organic compounds and natural products. *Exclusion:* CHEM 155 *Prerequisite:* CHEM 101 or CHEM 111

CHEM 155 Synthetic Laboratory I [0-2-5:4]

Experimental techniques of organic and inorganic chemistry; preparation, properties and reactions of representative compounds; separation, purification, analysis and spectroscopic characterization. *Prerequisite:* AL Chemistry

CHEM 212 Organic Chemistry II [3-0-0:3]

Continuation of CHEM 111. Dienes, resonance and aromaticity; electrophilic aromatic substitution and nucleophilic aromatic substitution; benzylic and allylic reactivity; the chemistry of carbonyl compounds and carboxylic acid derivatives; the chemistry of amines; pericyclic reactions. *Prerequisite:* CHEM 111

CHEM 222 Physical Chemistry II [3-0-0:3]

Basic quantum theory, atomic and molecular structure, equilibrium statistical thermodynamics. *Prerequisite:* CHEM 102 or CHEM 121

CHEM 232 Inorganic Chemistry II [3-0-0:3]

Mechanism of inorganic reactions, organometallic and bioinorganic chemistry, catalysis. *Prerequisite:* CHEM 131

CHEM 244 Analytical Chemistry II [3-0-0:3]

Continuation of CHEM 141. Topics covered include electrochemistry, mass spectrometry and separation sciences. *Prerequisite:* CHEM 141

CHEM 254 Molecular Characterization Laboratory II [0-2-5:4]

Instrumental methods in characterization of molecular properties. *Prerequisite:* CHEM 153

CHEM 256 Synthetic Laboratory II [0-2-5:4]

Use of advanced synthetic techniques, including inert atmosphere manipulations. *Prerequisite:* CHEM 155

CHEM 312 Structural Elucidation in Organic Chemistry [3-0-0:3]

Use of modern 1D- and 2D-NMR, IR, and Mass Spectrometric techniques for structure determination of organic molecules; theory of each technique with emphasis on development of problem-solving techniques. *Prerequisite:* CHEM 212

CHEM 313 Intermediate Organic Chemistry [3-0-0:3]

Provides further training in the multistep organic synthesis of natural and unnatural products, and will focus on the retrosynthetic analysis, pericyclic reactions, carbonium ion rearrangements and organic photochemistry. A prerequisite for students wishing to take CHEM 511/512 as part of their undergraduate program. *Prerequisite:* CHEM 212

CHEM 324 Polymer Chemistry [3-0-0:3]

Modern polymer synthesis, free radical and ionic initiation, macromolecular properties and characterization. *Prerequisite:* CHEM 101 or CHEM 212

CHEM 328 Molecular Materials for Electronics and Optics [3-0-0:3]

Liquid crystals, conducting polymers, photoconductors, nonlinear optical materials, optical information storage, photochromism, piezo- and pyroelectrical polymers, Langmuir-Blodgett films, resist materials for microelectronics, sol-gel glasses, molecular magnets, biosensors, and biomolecular optoelectronics. *Exclusion:* CHEM 554
Prerequisites: CHEM 222 and CHEM 324

CHEM 331 Intermediate Inorganic Chemistry [3-0-0:3]

Selected advanced topics in inorganic chemistry including spectroscopy (multinuclear NMR, IR and UV/visible), solid state chemistry, bioinorganic chemistry and catalysis. *Prerequisite:* CHEM 232

CHEM 332 Organometallic Chemistry [3-0-0:3]

Bonding, structure and reactivity of organometallic compounds, ligand substitution, oxidative addition, reductive elimination reactions, insertions and reactions of coordinated ligands, applications to catalytic processes and organic synthesis. *Prerequisite:* CHEM 232

CHEM 333 Solid State Chemistry [3-0-0:3]

Structure and bonding in solids; metals, semiconductors and dielectrics; crystal chemistry of ceramics, silicate minerals and zeolites; electrical, optical and magnetic properties of solids; fullerene chemistry; introduction to x-ray diffraction, electron microscopy, etc. *Prerequisite:* CHEM 232

CHEM 335 Intermediate Physical Chemistry [3-0-0:3]

Symmetry principle and group theory, molecular spectroscopy, advanced topics in molecular orbital theory and bonding, chemical kinetics. *Prerequisite:* CHEM 222

CHEM 342 Environmental Chemistry [3-0-0:3]

Chemical phenomena in the hydrosphere, lithosphere and atmosphere; their interaction with the biosphere; origin and treatment of pollutants and hazardous waste; environmental monitoring and analysis. *Prerequisite:* CHEM 141

CHEM 391 Chemical Information [1-0-0:1]

For Chemistry undergraduate students only. Accessing chemical information from library databases including chemical abstracts, Medline, science citation index and CCINFO. Graded P or F.

CHEM 392 Chemistry Undergraduate Seminar [0-1-0:1]

For Chemistry undergraduate students only. Each student is required to carry out a literature search on a selected topic under the supervision of a faculty member. He/she will submit a written report and give an oral presentation at the end of the semester. Graded P or F. *Pre-/Co-requisite:* CHEM 391

CHEM 398 Undergraduate Research [2-3 credits]

Offered every semester for two to three credits, and in the summer session for three credits. Students do original research in accordance with their ability and background, and under the supervision of a faculty. Enrollment in the course requires approval of the faculty supervisor and an average of grade B or above in Chemistry courses. Assessed by a letter grade and may be repeated for credit, but total credits may not exceed six. *Prerequisite:* CHEM 153 or CHEM 155

CHEM 399 Undergraduate Thesis [0-0-9:3]

The student performs original research and writes a thesis under the supervision of a faculty member. The thesis should include the results of original research carried out in CHEM 398. *Prerequisite:* CHEM 398

Postgraduate Courses:

CHEM 511 Advanced Organic Chemistry I [3-0-0:3]

Mechanism and theory in organic chemistry, molecular orbital theory, structure-activity relationships, isotope effects, solvent effects, neighboring group participation, and reactive intermediates. *Background:* CHEM 111, CHEM 112 and CHEM 313

CHEM 512 Advanced Organic Chemistry II [3-0-0:3]

Stereochemistry and conformational analysis, reactions of various classes of organic compounds, synthetic organic chemistry, modern methods of synthesis including specific methodologies and multistep complex syntheses. *Prerequisite:* CHEM 511

CHEM 516 Medicinal Chemistry [3-0-0:3]

Drug design, structure-activity relations, chemistry and biological effects of major classes of physiologically active and psycho-active drugs.

CHEM 521 Computational Chemistry [2-0-3:3]

Fundamentals and applications of various computational chemistry methods, including molecular orbital calculations, molecular mechanics and molecular dynamics. Computational laboratory practice will be emphasized. *Background:* CHEM 222
Exclusion: CHEM 323

CHEM 531 Advanced Inorganic Chemistry I [3-0-0:3]

Symmetry, group theory; molecular orbitals, electronic states; ligand field theory; electronic structure of metal complexes; theory of bonding and structure of inorganic compounds; chemistry of the elements; major physical methods used in the determination of molecular structure and bonding. *Background:* CHEM 234

CHEM 534 Chemical X-ray Crystallography [3-0-0:3]

Applications of X-ray diffraction methods to the determination of crystal structures, including crystal symmetry, reciprocal lattice, intensity of diffraction, the phase problem, and refinement of structure parameters, powder X-ray diffraction analysis.

CHEM 541 Atmospheric Chemistry [3-0-0:3]

A fundamental introduction to the physical and chemical processes determining the composition of the atmosphere and its implications for climate, ecosystems, and human welfare. Nitrogen, oxygen, carbon, sulfur geochemical cycles. Climate and the greenhouse effect. Atmospheric transport and turbulence. Stratospheric ozone. Oxidizing power of the atmosphere. Regional air pollution: aerosols, smog, and acid rain. *Background:* Basic knowledge of physical chemistry

CHEM 543 Advanced Environmental Analytical Chemistry [3-0-0:3]

Special topics in Analytical Chemistry with environmental application. Advanced readings on environmental microbiology and biotechnology. *Background:* ESCE 520

CHEM 544 Bioanalytical Chemistry [3-0-0:3]

The use of biomolecules for analytics: Enzyme and immunotests, DNA probes, biosensors and biopipsticks. Application of analytical techniques for bio- and medical sciences. *Background:* basic knowledge of biochemistry *Prerequisite:* CHEM 141

CHEM 554 Molecular Materials for Electronics and Optics [3-0-0:3]

Liquid crystals, conducting polymers, photoconductors, nonlinear optical materials, optical information storage, photochromism, piezo- and pyroelectrical polymers, Langmuir-Blodgett films, resist materials for microelectronics, sol-gel glasses, molecular magnets, biosensors, and biomolecular optoelectronics. *Exclusion:* CHEM 328

CHEM 600 Chemistry Seminar [0-1-0:1]

Series of seminar topics presented by students, faculty and visiting speakers; may be repeated for credit. Graded P or F.

CHEM 601 Special Topics in Chemistry (JCAS) [2-4 credits]

Advanced courses in postgraduate Chemistry including those offered by sister institutions in Hong Kong under the Joint Center for Advanced Studies initiative. Credit to be determined on case by case basis based on workload.

CHEM 602 Special Topics in Physical Chemistry [3-0-0:3]

Selected, specialized topics in physical chemistry; current trends in the literature; major new advances not covered in general courses; advanced concepts.

CHEM 699 MPhil Thesis Research

Master's thesis research supervised by a faculty member. A successful defense of the thesis leads to the grade Pass. No course credit is assigned.

CHEM 799 Doctoral Thesis Research

Original and independent doctoral thesis research. A successful defense of the thesis leads to the grade Pass. No course credit is assigned.