Department of Chemistry

Chairperson:	Al-Ghoul, Mazen H.
Professors:	Haddadin, Makhlouf J.; Sultan, Rabieh F.
Associate Professors:	Al-Ghoul, Mazen H.; Bouhadir, Kamal I.; Halaoui, Lara I.
Assistant Professors:	El-Rassy, Houssam T.; Ghaddar, Tarek H.; Ghauch, Antoine, R.; Hasanayn, Faraj A.; Kaafarani, Bilal R.; Saliba, Najat I.
Instructors:	Deeb, Hana H.; Abi Rafii, Randa R.; Sadek, Samar A.

Undergraduate Program

Students are accepted as provisional majors in the sophomore year. In order to be accepted as a regular major in the junior year a student must have passed CHEM 201 with a minimum grade of 70, must obtain a 70 average in all other chemistry courses taken, a minimum average of 70 in all mathematics and physics courses taken, and CMPS 209/200. As a major, the student must complete the following minimum requirements: CHEM 201, CHEM 211, CHEM 212, CHEM 215, CHEM 216, CHEM 217, CHEM 218, CHEM 220, CHEM 225, CHEM 228, CHEM 229, and CHEM 230; at least two elective courses of the following four courses: CHEM 231, CHEM 232, CHEM 233, and BIOL 220; in addition to MATH 201, MATH 202, and CMPS 209 or CMPS 200; PHYS 211 and PHYS 211L or PHYS 228 and PHYS 228L.

Freshman students who intend to **major** in chemistry should complete the following minimum requirements: CHEM 101 and CHEM 102, MATH 101 and MATH 102. PHYS 101 and PHYS 101L are useful science electives.

Students who intend to **minor** in chemistry should complete the following requirements: CHEM 201, one course from CHEM 206 or CHEM 215, CHEM 211, CHEM 212, CHEM 228, and one course from CHEM 217 or CHEM 218, for a total of 18 or 19 credits. MATH 201 is a prerequisite for a minor in chemistry.

For a premedical chemistry student the core premedical chemistry courses are CHEM 201, CHEM 211, CHEM 212, CHEM 216, and CHEM 225 for a total of 15 credits. The biology premedical courses are BIOL 201 and BIOL 202 (8 credits).

The physics requirements for a premedical chemistry student are any one of the following six combinations[1]:

A. PHYS 211, PHYS 211L, PHYS 228, PHYS 228L (8 cr.)
B. PHYS 211, PHYS 211L, PHYS 210, PHYS 210L (8 cr.)
C. PHYS 210, PHYS 210L, PHYS 228, PHYS 228L (8 cr.)
D PHYS 211, PHYS 210, PHYS 221L (8 cr.)
E. PHYS 228, PHYS 228L, PHYS 210, PHYS 221L (9 cr.)
F. PHYS 228, PHYS 228L, PHYS 211, PHYS 221L (9 cr.)

The chemistry core courses for non-chemistry major premedical students are CHEM 201, CHEM 206, CHEM 210, CHEM 211, and CHEM 212, for a total of 15 credits.

1 These requirements apply to students entering as of summer 2004

CHEM 101 General Chemistry I 3.3; 4 cr.
An introductory course that covers atomic structure, chemical bonding, gas laws, stoichiometry, solutions, chemical equilibrium, and other basic concepts. Includes laboratory practice. *Each semester.*

CHEM 102 General Chemistry II 3.3; 4 cr.
A course that covers acid-base and solubility equilibria and introductory thermodynamics; surveys common groups in the periodic table; provides an introduction to organic chemistry, nuclear chemistry, and electrochemistry. Includes laboratory practice. *Prerequisite: CHEM 101. Each semester.*

CHEM 200 Basic Chemistry 3.0; 3 cr.
A course that stresses the fundamental chemical principles, such as stoichiometry, acids and bases, the phases of matter, basic thermodynamics, and solutions. Designed for students majoring in agriculture, nursing, public health, and medical laboratory technology. *Students cannot receive credit for both CHEM 200 and CHEM 201. Each semester.*

CHEM 201 Chemical Principles 3.0; 3 cr.
A theoretical introduction to chemical principles, stressing atomic structure, bonding, stoichiometry, gases, solutions, acids and bases, solution equilibria. Designed for students with a background in chemistry equivalent to CHEM 101. *Students cannot receive credit for both CHEM 200 and CHEM 201. Each semester.*

CHEM 202 Introduction to Environmental Chemistry 3.0; 3 cr.
An introduction to the fundamentals of physical, inorganic, and organic chemistry, with applications to environmental problems. This course surveys atomic and molecular structure, solutions, equilibrium, acids and bases, oxidation-reduction, reaction kinetics with emphasis on mechanisms of organic free radical reactions, and basic radioactivity. *Students can receive credit for CHEM 201 and CHEM 202. Prerequisite: CHEM 101 or equivalent. Each semester.*

CHEM 203 Introductory Chemical Techniques 1.3; 2 cr.
A laboratory course on the methods of quantitative analysis, physical chemistry measurements, and inorganic semi-micro qualitative analysis, with applications to environmental problems. *Not open to chemistry majors. Pre- or corequisite: CHEM 200, 201, or 202. Annually.*

CHEM 205 Introductory Chemistry Laboratory 1.4; 2 cr.
A laboratory course on the methods of quantitative analysis, physical chemistry measurements, and inorganic semi-micro qualitative analysis. *Not open to chemistry majors. Pre- or corequisite: CHEM 200, 201, or 202. Each semester.*

CHEM 206 Quantitative Analysis 3.4; 4 cr.
A course that covers gravimetric and volumetric techniques; acid/base, complex formation, and redox titrations; electrochemistry and an introduction to chromatography and spectrophotometric analysis. This course is designed for biology majors. *Not open to chemistry majors. Students cannot receive credit for both CHEM 206 and CHEM 215–216. Prerequisite: CHEM 201. Each semester.*

CHEM 208 Brief Survey of Organic Chemistry 3.0; 3 cr.
A brief survey designed for students majoring in agriculture or public health that covers the following topics: hydrocarbons, stereoisomerism, organo halogens, oxygen containing groups, carbonyl groups, carboxylic acids and their derivatives, amines, carbohydrates, and amino-acids. *Students cannot receive credit for both CHEM 208 and CHEM 211. Prerequisite: CHEM 102 or equivalent. Each semester.*

CHEM 209 Introductory Organic Laboratory 1.4; 2 cr.
A course of basic experiments in organic chemistry, including synthesis and techniques of separation and purification of organic compounds. *Students cannot receive credit for more than one course among CHEM 209 and CHEM 210. Pre- or corequisite: CHEM 208. Each semester.*

CHEM 210 Organic Laboratory for Non-Majors 1.4; 2 cr.
Basic experimental techniques in organic analytical chemistry (melting and boiling point, chromatography, distillation, extraction, recrystallization), performing reactions in synthetic organic chemistry. *Students cannot receive credit for more than one course between CHEM 209 and CHEM 210. Pre- or corequisite: CHEM 212. Each semester.*

CHEM 211 Organic Chemistry I 3.0; 3 cr.
An introduction to organic chemistry organized according to functional groups. This course covers synthesis, properties, and reactions of aliphatic and aromatic hydrocarbons and alkyl halides, with emphasis on mechanistic and stereochemical aspects of organic reactions. Designed for chemistry majors and premedical study. *Students cannot receive credit for both CHEM 208 and CHEM 211. Prerequisite: CHEM 201. Each semester.*

CHEM 212 Organic Chemistry II 3.0; 3 cr.
Synthesis, properties, and reactions of organic functional groups, including alcohols and ethers, aldehydes and ketones, carboxylic acids and derivatives, amines, phenols, and aryl halides; chemistry of difunctional compounds and of molecules of biological importance, including carbohydrates, proteins, and nucleic acids; and, organic structure determination by spectroscopic methods. Emphasis is placed on reaction mechanism and stereochemistry, as well as on the design of multi-step syntheses. Designed for chemistry majors and premedical study. *Prerequisite: CHEM 211. Each semester.*

CHEM 215 Analytical Chemistry 3.0; 3 cr.
A course that covers fundamental analytical processes, including solution equilibria, titrations, electrochemical theory and applications, chromatography and spectrophotometric techniques. *Students cannot receive credit for both CHEM 215 and CHEM 206. Prerequisite: CHEM 201. Annually.*

CHEM 216 Analytical Chemistry Laboratory 1.4; 2 cr.
Experimental work in related areas of chemical analysis and instrumentation; acid/base titrations, pH measurements, complexometric analysis, electrochemical determination of electrode potentials and ion activities; ion-selective electrodes; spectrophotometric analysis. *Pre- or corequisite: CHEM 215. Annually.*

CHEM 217 Thermodynamics and Chemical Dynamics 3.0; 3 cr.
A course that covers the basic principles of chemical thermodynamics and chemical dynamics; mathematical machinery of the laws of thermodynamics; heat, work, and energy; first, second and third laws of thermodynamics; thermodynamics of chemical reactions; thermodynamics of solutions; transport properties: diffusion, viscosity, ion transport, thermal conductivity; chemical kinetics; collision theory; activated complex theory. *Prerequisites: CHEM 201 and MATH 201. Annually.*

CHEM 218 Molecular Structure 3.0; 3 cr.
Failures of classical physics, quantum theory, Schrédinger equation, particle in a box, harmonic oscillator, rotational motion, hydrogen atom, atomic orbitals, spin, Pauli exclusion principle, complex atoms, term symbols, molecular structure, hybridization, Héckel theory, rotation, vibration, and electronic spectra. *Students cannot receive credit for both PHYS 212 and CHEM 218*[2]. *Prerequisites: CHEM 201 and MATH 201. Annually.*

CHEM 220 Physical Chemistry Laboratory 1.6; 3 cr.
Experiments in thermodynamics, kinetics, electrochemistry, spectroscopy, and exercise in computational chemistry. *Prerequisite: CHEM 217, pre- or corequisite: CHEM 218. Annually.*

CHEM 225 Organic Structure Determination 1.6, 4 cr.
Experiments in the techniques of purification, separation, and synthesis of derivatives of organic compounds; theory and practice in the analysis of organic compounds by infrared, ultraviolet-visible spectrophotometry, mass spectrometry, and nuclear magnetic resonance; identification of pure compounds and of components of mixtures of organic compounds by chemical and spectral methods. *Prerequisite: CHEM 212. Annually.*

CHEM 227 Technical Analysis 1.4, 3 cr.
Applications of chemical analysis to the analysis of natural and industrial products such as water, milk, textiles, liquors, oils, petroleum. Industrial techniques such as sample preparation and preconcentration. Separation and identification techniques: extraction, chromatography, and spectroscopy. *Prerequisite: CHEM 215. Alternate years.*

CHEM 228 Inorganic Chemistry 3.0; 3 cr.
Atomic structure, molecular structure (VBT, MOT), molecular shape (VSEPR), symmetry and group theory, the structure of solids (metals, ionic), acids and bases (Bronsted, Lewis, HSAB, solvents). *Prerequisite: CHEM 201. Annually.*

CHEM 229 Coordination Compounds 3.0; 3 cr.
A course that covers d-metal complexes (structures and symmetries, bonding and electronic structure, reactions of complexes); electronic spectra of complexes; reaction mechanisms of d-block complexes (ligand substitution reactions in square-planar and octahedral complexes, redox reactions, photochemical reactions). *Prerequisite: CHEM 228. Annually.*

CHEM 230 Senior Seminar 1 cr.
A literature search of a specific topic in chemistry. A written report and oral presentation in a seminar form. *Prerequisite: Senior standing. Each semester.*

CHEM 231 Organic Synthesis 1.4; 3 cr.
Experiments in multistep synthesis of organic compounds, with an emphasis on methods used for synthesis and isolation, and characterization of intermediates and products. *Pre- or corequisite: CHEM 212. Annually.*

CHEM 232 Inorganic Synthesis 1.4; 3 cr.
Experiments in synthesis, separation, purification, and characterization of inorganic main-group and transition metal compounds by IR, UV-Vis, NMR, and ESR spectroscopy. *Prerequisite: CHEM 228. Annually.*

2 Applies to students entering as of summer 2004

CHEM 233 Topics in Physical Chemistry 3.0; 3 cr.
A course that covers a selection of topics in thermodynamics, advanced kinetics, and techniques in physical analysis; thermodynamics of phase transformation; theoretical and experimental aspects of rates of reactions; rate laws of complex reactions, catalysis, adsorption isotherms, spectroscopic techniques (e.g., laser spectroscopy, NMR, EPR); surface analysis and imaging techniques; X-ray crystallography. *Prerequisite: CHEM 217; and pre- or corequisite: CHEM 218. Annually.*

CHEM 295 Special Topics in Chemistry 3.0; 3 cr.
Prerequisite: senior standing in chemistry.

CHEM 299 Independent Study 3 cr.
Independent chemical research carried out under the direction of a faculty member, including presentation of the results in the form of a senior thesis. Offered to senior students in good standing, by arrangement with the project director. *Each semester.*

34 + 6 credits in Chemistry

Modes of Analysis	English and Arabic (9)	Humanities (12)	Social Sciences	Sciences, Math, and Technology (53–56)
Lecture courses (57–63)	1. Required Arabic course: 201A or B, or any upper level course (3) 2. Required English courses: 203(3), 204(3)	Required credits in the humanities: 12 credits including 6 credits from CVSP (see pp. 152-54)	Electives[1] (unspecified): highly recommended is an introductory course in economics (e.g., ECON 203, 211, 212)	1. Chemistry courses (24–30) Core: CHEM 201(3), 211(3), 212(3), 215(3), 217(3), 218(3), 228(3), 229(3) Electives[2]: CHEM 233(3), BIOL 220(3) 2. Science courses (12 cr.): PHYS 211(3) or PHYS 228(3), MATH 201(3), MATH 202(3), CMPS 209 or 200(3)
Seminar (1)				CHEM 230(1)
Laboratory (13–19)				1. Chemistry courses (9–15) Core: CHEM 216(2), 220(3), 225(4) Electives[2]: CHEM 231(3), 232(3) 2. Science courses (1): PHYS 211L or 228L(1) + CMPS 209 or 200(3)[3]
Research project (0 or 3)				CHEM 299(3)[4]

1 The number of free elective credits totals 16. Students can fulfill the economics and social sciences requirements in the various modes of analysis from these credits.
2 Students take, in addition to the 33 credits of core chemistry courses and the seminar course (230), 6 credits of the following elective courses of chemistry or biochemistry: CHEM 231, CHEM 232, CHEM 233, BIOL 220.
3 CMPS 209 is counted only once in the science credits above (53–56). It is, however, included and counted in both lecture and lab modes of analysis.
4 Not a requirement; could be taken as part of the 16 credits.

THE REQUIREMENTS LISTED ABOVE APPLY TO STUDENTS WHO JOINED THEIR MAJOR AS OF OCTOBER 1, 2001–02. STUDENTS WHO JOINED A MAJOR PRIOR TO THAT DATE SHOULD CONSULT THE 2000–01 CATALOGUE