

Department of Chemistry

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BS in Chemistry

Mission Statement

The Chemistry Department provides liberal arts and professional education in chemistry. The undergraduate program at the department is dedicated to teaching, scholarship, research and creative endeavors. Through this program, the department delivers a strong theoretical course of study and practical training in the chemical sciences to assure the success of its students in graduate schools, professional schools and employment. Undergraduate students are able to explain the essential facts, principles and theories across the four major areas of chemistry, i.e. analytical, organic, inorganic and physical. In addition, they are strongly encouraged to be engaged in research in these aforementioned areas. The program also plays a central role in the education of students of other majors, including students of Medicine, Health Sciences, Engineering, and Agriculture.

Students accepted as chemistry majors must maintain an average of 70 or above in their first three semesters in major courses in order to remain in the program. Students must complete the following minimum requirements: CHEM 201, CHEM 201L, 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 five courses: CHEM 231, CHEM 232, CHEM 233, CHEM 234 and BIOL 220, in addition to MATH 201, MATH 202, and CMPS 209 or CMPS 200, PHYS 211 and PHYS 211L, 6 credits in the Social Sciences, and 12 credits in the Humanities. It is highly recommended that chemistry majors complete MATH 201 and MATH 202 before taking CHEM 217 and CHEM 218.

The 90-credit requirement for a BS degree in Chemistry is distributed as follows:

Degree Requirements

- Major courses: 40 credits in Chemistry courses (33 credits as required courses, 6 credits as elective courses, and 1 credit as a seminar course)
- Natural Sciences courses: 4 credits of Physics
- Quantitative Thought courses: 9 credits (6 credits in Math and 3 credits in CMPS)
- University General Education requirements that include 6 credits in English Communication Skills, 3 credits in Arabic Communication Skills, 12 credits in the Humanities including 6 credits of CVSP, and 6 credits in the Social Sciences
- Elective courses: 10 credits in free electives

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

Students who intend to minor in chemistry should complete the following requirements:

- CHEM 201, one lab course from the following list (CHEM 201L, CHEM 203, CHEM 209 or CHEM 210) and a minimum of 12 credits from courses selected from at least three of the below four chemistry divisions:
 - Analytical: CHEM 215, CHEM 219, CHEM 234
 - Inorganic: CHEM 228, CHEM 229
 - Organic: CHEM 207, CHEM 208, CHEM 211, CHEM 212
 - Physical: CHEM 217, CHEM 218, PHYS 212, [CHEM 204 and MECH 310]
- Typical choice of minors for different majors:
 - Biology: 201, 201L/210, 211, 212, 215, 228 (16/17 credits)
 - Physics: 201, 201L/209/210, PHYS 212, 215/217, 208/211/212/228 (16/17 credits)
 - Geology: 201, 201L/209, 208, 215, 228, 229 (16/17 credits)
 - Chemical Engineering: 201, 201L/209, 207, 219, (204 and MECH 310) (16/17 credits)
- For a premedical chemistry student, the core premedical chemistry courses are: CHEM 101 + CHEM 101L (or equivalent), CHEM 201, CHEM 211, CHEM 212, and CHEM 225. The biology premedical courses are BIOL 101 (or equivalent) and BIOL 200 or BIOL 201. The physics requirements for a premedical chemistry student are PHYS 211 and PHYS 211L.
- The chemistry core courses for non-chemistry major premedical students are: CHEM 101 + CHEM 101L (or equivalent), CHEM 201, CHEM 210, CHEM 211, and CHEM 212.

- 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. Prerequisites: CHEM 101 and CHEM 101L or equivalent. Every 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, CHEM 201, or CHEM 202. Annually.*
- CHEM 204 Physical Chemistry for Chemical Engineers 2.0; 2 cr.**
An introduction to the basic principles of chemical kinetics, surface phenomena and colloids: reaction rates and mechanism; theories of reaction rates; catalysis; photochemistry; colloids; adsorption on surfaces; surface analytical techniques. *Prerequisites: CHEM 102 and CHEM 102L. Not open to Chemistry students. Every summer.*
- 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 corequisites: CHEM 200, CHEM 201, or CHEM 202. Every 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. Occasionally.*
- Chemistry 207 Survey of Organic Chemistry and Petrochemicals 3.3; 4 cr.**
A survey of organic chemistry which mainly covers properties and reactions of aliphatic and aromatic hydrocarbons, functional groups, including alkyl halides, alcohols and ethers, aldehydes and ketones, carboxylic acids and derivatives. This course surveys polymers, petrochemicals and their general use in industry. The laboratory component covers the basic organic lab skills such as recrystallization, distillation, extraction, chromatography and some synthesis experiments. *Designed for chemical engineering students. Students cannot receive credits for both CHEM 208 and CHEM 207; CHEM 211 and CHEM 207. Prerequisite: CHEM 102 or equivalent. Annually.*
- 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. Prerequisites: CHEM 101 and CHEM 101L; or CHEM 200 or equivalent. Every semester.*

CHEM 209 Introductory Organic Laboratory 1.3; 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 between CHEM 209 and CHEM 210. Pre- or corequisite: CHEM 208. Every 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. Every 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. Every semester.*

CHEM 212 Organic Chemistry II 3.0; 3 cr.
A course that covers 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. Every 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. Every semester.*

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. *Prerequisite: CHEM 201; pre- or corequisite: CHEM 215. Every semester.*

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, phase transformations and phase equilibria; thermodynamics of solutions; transport properties: diffusion, viscosity, ion transport, thermal conductivity; chemical kinetics and reaction mechanisms. *Pre- or corequisite: MATH 202. Annually.*

- CHEM 218 Molecular Structure 3.0; 3 cr.**
A course that covers failures of classical physics, quantum theory, Schrödinger equation, particle in a box, harmonic oscillator, rotational motion, hydrogen atom, atomic orbitals, spin, Pauli exclusion principle, complex atoms, term symbols, molecular structure, hybridization, Hückel theory, rotation, vibration, and electronic spectra. *Students cannot receive credit for both PHYS 212 and CHEM 218. Pre- or corequisite: MATH 202. Annually.*
- CHEM 219 Analytical and Instrumental Chemistry 3.0; 3 cr.**
for Chemical Engineers
An introduction to chemical measurements and modern instrumental methods of chemical analysis: sample preparation; error analysis; chemical separations; chromatographic; spectroscopic; electrochemical, and surface analysis techniques. Not open to chemistry students. *Prerequisites: CHEM 102 and CHEM 102L. Annually.*
- CHEM 220 Physical Chemistry Laboratory 1.6; 3 cr.**
Experiments in thermodynamics, kinetics, electrochemistry, spectroscopy, and exercise in computational chemistry. *Prerequisites: CHEM 201L and CHEM 217. Pre- or corequisite: CHEM 218. Annually.*
- CHEM 225 Organic Structure Determination 1.6; 3 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. *Prerequisites: CHEM 201L and 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.**
A course that covers atomic structure, molecular structure (VBT, MOT), molecular shape (VSEPR), symmetry and group theory, the structure of solids (metals, ionic, acids and bases (Brønsted, 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 1.0; 1 cr.**
A literature search of a specific topic in chemistry. A written report and oral presentation in a seminar form. *Prerequisite: Senior standing. Every semester.*

34 + 6 Credits in Chemistry

Modes of Analysis	English and Arabic (9)	Humanities (12)	Social Sciences	Natural Sciences (44-47)	Quantitative Thought (9)
Lecture courses (57–63)	<ul style="list-style-type: none"> Required Arabic course (3) Required English courses: 203(3), 204(3) 	<ul style="list-style-type: none"> Required credits in the humanities: 12 credits including 6 credits from CVSP 	<ul style="list-style-type: none"> 6 credits required¹ 	<ul style="list-style-type: none"> Chemistry courses (24–30) Core: CHEM 201(3), 211(3), 212(3), 215(3), 217(3), 218(3), 228(3), 229(3) Electives²: CHEM 233(3), CHEM 234(3), BIOL 220(3) Science courses (12 cr.): PHYS 211(3) 	<ul style="list-style-type: none"> Math and Computer Science courses: MATH 201(3), MATH 202(3), CMPS 209 or 200(3)
Seminar (1)				<ul style="list-style-type: none"> CHEM 230(1) 	
Laboratory (13–19)				<ul style="list-style-type: none"> Chemistry courses (9–15) Core: CHEM 201L(1), CHEM 216(2), 220(3), 225(3) Electives²: CHEM 231(3), 232(3) Science courses (1): PHYS 211L 	<ul style="list-style-type: none"> Computer Science (3): CMPS 209 or 200(3)³
Research Project (0 or 3)				<ul style="list-style-type: none"> CHEM 299(3)⁴ 	

1) The number of free elective credits totals 10. 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 CHEM 230, 6 credits of the following elective courses of chemistry or biochemistry: CHEM 231, CHEM 232, CHEM 233, CHEM 234, 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 10 credits.