Chemistry Program Course Description

B.SC Requirement in Chemistry

Course Descriptions

General Chemistry (9102101) :

General Chemistry is a one semester introduction to chemistry. The course takes on the discipline from a logical approach. It begins with a quick overview of matter and measurements and then proceeds to atomic theory, electronic theory, bonding and hybridization, the mole, reaction stoichiometry, chemical reactions and covers an introduction to thermodynamics and kinetics. The course aims at providing the students with enough knowledge to proceed to Physical Chemistry and Organic Chemistry I in the following semester. The course is taught in a small class setting, it relies on a combination of lectures and in class workshops that introduce students to the liberal arts college teaching pedagogy, where students are at the center of the learning experience.

Organic Chemistry I (9102201):.

This course introduces the basic concepts of organic chemistry from naming, functional groups, curved arrow notation substitution and elimination reactions, isomerism, stereochemistry and other topics. It aims at training students in reaction mechanism writing to further prepare them for upper level courses. The teaching takes on a thematic approach encouraging students to recognize general themes rather than memorize specific reactions, and therefore encouraging critical thinking and questioning a key goal of a liberal arts college education. Students are constantly given examples of compounds from the plastic, pharmaceutical and chemical industries to help solidify many theoretical concepts. The course encourages group work and requires students to engage with recent research in the field by introducing exam questions inspired from the latest scientific literature.

Organic Chemistry II (9102202):

Organic Chemistry II is a continuation of organic I. We usually pick up exactly where we left off in Organic I. The materials covered in this course will rely heavily on the knowledge acquired in the previous semester. Organic II will prepare the student for Biochemistry and other advanced chemistry and biology classes. Students will be further exposed to mechanism writing, retrosynthetic analysis, stereochemistry, stereospecific reactions and total synthesis along with basic concepts of aromaticity, carbonyl compounds. At the end of this course the students will have a comprehensive knowledge of Organic chemistry and will be able to moderate into their Chemistry major comfortably. The course draws on latest scientific literature in the organic chemistry field and requires students to engage critically with the concepts presented in the course. To insure an interdisciplinary approach, students are encouraged to examine a variety of organic chemistry topics from biological, physical and synthetic views. A specific exercise that is key to this course is the paper analysis exercise where students are given a primary literature paper and a set of questions. They are required to read and answer the questions in a response paper. This develops students' ability to read and write scientific literature.

Organic Chemistry Lab Techniques (9102203):

A two credit course spanning techniques from distillation, synthesis of organic compounds, structural elucidation and computer based drug design. A special focus on synthetic chemistry techniques and different chromatographic and spectroscopic techniques. The course culminates in a final uknown identification experiment that ties together all the techniques that students learn through the semester. In going with the college's mission to produce good writers in all fields students write lab reports on all experiments and write a final report that follows scientific journal writing guidelines.

Thermodyanmics and Kinetics (9102204):

In the first two-thirds of the course, concepts of enthalpy, entropy and free energy are developed as a basis for understanding the nature of chemical stability. In the last third of the course, the tools of rate measurement and analysis are used to understand chemical reactivity. Laboratory work includes the application of calorimetric, potentiometric and spectrophotometric methods to study of thermodynamic and kinetic problems. Several applications utilizing computer-interfaced measurements are included. The course also

introduces computational chemistry and gives students the opportunity to do hands on computation research in a small scaled project. This reinforces our mission as a college to produce not only theoretically proficient graduates but also practically savvy students.

Analytical Chemistry (9102205) :

Designed for chemistry majors, minors and pre-health professionals. Problem-based learning course designed to provide a working knowledge of the principles and practices of analytical chemistry. Covers two major themes: (1) the systematic treatment of chemical equilibrium in ionic systems, including acid-base, solubility, redox, and (2) methods of quantitative chemical analysis, which includes the theory and practice of volumetric analysis and the modern instrumental methods of analysis used in industrial analytical laboratories (spectroscopy and chromatography techniques). Culminates in a three-week laboratory group project and a poster presentation. The problem solving interdisciplinary approach puts students at the heart of the learning experience which is a key feature of a liberal arts education.

Biochemistry (9102301):

An interdisciplinary course that intimately combines biology and chemistry. This course covers fundamental biological pathways from a chemical point of view. The course examines enzyme structures and mechanisms, receptors structure and mechanisms, binding pockets, substrate binding mechanism and many other topics that will allow students to gain a basic molecular understanding of biological pathways. The course is taught in small class size and greatly depends on examining primary scientific literature with a final student presentation on a topic chosen by the student.

Inorganic I (9102302):

A systematic examination of the chemical elements and their compounds, with an emphasis on periodicity of properties. Examines bonding theories, group theory and reaction mechanisms as well as ligand theory. A particular emphasis placed on the coordination compounds and organometallic compounds of the transition metals. The course is taught in a small class setting, with emphasis on student participation, and scientific writing.

Advanced Organic (9102303):

Advanced Organic chemistry is a continuation for Organic I and II. The course aims at further developing student's organic chemistry knowledge and prepares students to enroll in upper level selected topic courses. It examines organic chemistry reactions from both synthetic and mechanistic points of view. It covers aromaticity, aromatic compound reactions. It also considers carbonyl chemistry reactions, their stereo and regiochemistry, synthetic use, and mechanistic approaches. It also covers a selected group of named organic reactions, their conditions, uses and mechanisms. Primary literature analysis and commentary are integral to the course make up. This course will prepare students for future graduate work in the area of organic chemistry.

Advanced Organic Chemistry Lab (9102304):

A one credit hour course taken during or after Advanced Organic Chemistry is completed, focuses on multistep syntheses, medicinal chemistry with a special emphasis on the synthetic uses of organic reactions.

Palestinian Medicinal Plants (9102206):

A scientific literature review based course examining the different medicinal plants in Palestine, natural product isolation, structural elucidation and biological activity. This course is heavy on student participation and requires extensive reading and writing.

Detergents Soaps and Cosmetics (9102207):

This course examines the intricate chemistry of soap and cosmetics. The cosmetic industry today is one of the most lucrative industries. Cosmetic manufacturing is largely a chemical industry and this course will expose students to basic cosmetics and soap making ingredients, their activity, the basic chemical mechanisms of action. It also touches on the biological activity of certain ingredients and the difference between natural and synthetic ingredients. Students will get the opportunity to examine the latest scientific literature in cosmetics. The course will include a term paper that focuses on one of the cutting edge topics of this industry. In compliance with the college pedagogy, this course can only hold ten to twelve students and will give plenty of room for student participation, writing and engaging with the materials. It will also have a small practical component that allows students to gain hands on experience in cosmetic making.

Environmental Chemistry (9102208):

A study of natural and unnatural chemical substances in the environment with particular emphasis on the problem of chemical pollution and its health consequences. Includes air pollution, global warming, water quality, heavy metals, pesticide residues and other organic compounds. Principles of chemical equilibrium and reaction mechanisms emphasized. The course will also draw on relevant problems in the Palestinian environment to help deepend the students understanding of the basic chemical concepts covered.

Organic Synthesis (9102209):

This course examines a variety of total syntheses of natural and synthetic compounds that have contributed greatly to the organic synthesis body of knowledge and have also produced biologically significant molecules that are used in medicine, environmental chemistry, cosmetics and food. The course references the two books Total Synthesis and Total Synthesis II by Nickalau as the main textbook, but in order to achieve the main pedagogical goal of reading and writing scientific literature, students will examine the total syntheses of a set of molecules by reading the primary scientific papers for each compound. Students will be encouraged to look at how total synthesis helps contribute to our mechanistic knowledge of organic reactions.

Quantum Mechanics (9102305):

A study of quantum mechanics as applied to chemical systems. Explores a range of problems in quantum mechanics, from the simple particle-in-a-box case to the hydrogen atom, pi-electron systems and time-dependent systems. Also includes the theoretical basis and practical applications of computational chemistry.

Materials Chemistry (9102306):

Basic principles of chemistry with an emphasis on structure and bonding, thermodynamics, kinetics, and ideal solids. Introduction to real (defect-containing) solids and equilibria and kinetic processes in solids. Macroscopic properties, such as mechanical strength and electrical conductivity, are dominated by structure and bonding, and the course continuously emphasizes this connection. Each of the materials classes (metals, ceramics, semiconductors, and polymers) is discussed in detail in this context.

Polymer Chemistry (9102307):

The course encompasses the study of polymers, polymerization reactions, copolymerization, polymer characterization, physical and chemical properties and typical application. The latest polymer chemistry topics are examined through student run literature reviews and presentations. T

Fats and Oils (9102308):

This involves a detailed study of fats oils and waxes. The basic chemistry of raw materials used in different industries, quality control and testing. Students will apply basic chemistry principles they learned in previous classes to fats and oils analysis. The lab component will expose students to a variety of tests and techniques used to analyze fats and oils.

Instrumental Analysis (9102309):

The major Topics of study include three main parts for qualitative and quantitative analysis by using modern Instrumentation's: Part I: Chromatography: Including TLC, HPLC, GC/MC and Electrophoresis, Part II: Spectroscopy: including UV/Vis, Fluorescence, atomic Absorption.ICP. Part III: Electrochemistry.

Inorganic II (9102310):

This course is a sequence course of inorganic I. This course will focus on coordination chemistry, ligand field theory, bonding, spectra of coordination compounds, and magnetic properties. It also exposes students to reactions and mechanisms of inorganic complexes.

Inorganic Lab Techniques (9102311):

This course is a practical application of both Inorganic I and Inorganic II. Students will follow a set of experiments that include synthesis, instrumental and physical analysis for compound characterization and structural elucidation. The students are also expected to engage with a long term project of synthesis and structural elucidation of a given complex. A final report written in the form of a scientific paper following American Chemical Society guidelines forms is required as part of student assessment and evaluation in the course. The paper is presented to class peers in a conference style power point presentation and is subject to peer review and evaluation.

Selected Topics (9102312):

A selected topics course will be offered based on faculty availability and student interest. Selected topics in all fields of chemistry will be offered at least once a year.

Organometallics (9102402) :

For the first quarter of the semester the course revisits some of the themes in Inorganic II but engages students on a higher level with these topics. For the remainder of the semester, this course focuses on organometallic catalysts, their synthesis and mechanism of action. A true interdisciplinary course between inorganic and organic chemistry.

Medicinal Chemistry-Drug Design (9102403):

This is a hands on course in drug design and discovery using docking techniques for enzymes and receptors. This is a project based course which culminates in a semester long project on original work be submitted in the form of a scientific paper and a presentation.

Pharmaceutical Chemistry (9102404):

This course involves preparatory methods of typical drugs for both Internal and external use, with a survey of the chemistry of some therapeutic classes, such as Antibiotics & Analgesic. The course deals also with drugs manufacture and formulations, quality control & quality assurance.

Computational Chemistry (9102405):

This course provides an overview of computational chemistry techniques including molecular mechanics, molecular dynamics and both semi-empirical and ab initio electronic structure theory. Sufficient theoretical background is provided for students to understand the uses and limitations of each technique.

Biorganic Chemistry (9102406):

Topics covered include the chemistry of biomolecules (carbohydrates, lipids, amino acids, and nucleotides); mechanisms and kinetics; biosynthesis and function of macromolecules including DNA, RNA, and proteins; introduction to biotechnology and recombinant DNA techniques.

Selected Topics (9102408):

A selected topics course will be offered based on faculty availability and student interest.