1.	School	Science
2.	Department	Chemistry
3.	Degree title (Arabic)	دكتوراه الكيمياء
4.	Degree title (English)	Doctorate in Chemistry

	Specialization #	Degree	Dep #	Faculty #	Year	Track
Plan Number					2011	

First: General Rules & Conditions:

1. This plan conforms to valid regulations of the programs of graduate studies.
2. Specialties of Admission:
   - Master degree in Chemistry

Second: Special Conditions: None

Third: Study Plan: Studying (54) Credit Hours as follows:

1. **Obligatory Courses (21) credit hours:**

Course No.	Course Title	Credit Hrs	Theory	Practical	Pre/Co-requisite
0303912	Electrochemical Methods of Analysis	3			-
0333913	Advanced Chromatography	3			-
0333921	Organometallic Chemistry	3			-
0333932	Synthetic Organic Chemistry	3			-
0303933	Natural Products Chemistry	3			-
0333941	Applications in Quantum Chemistry	3			-
0333961	Seminar	3			-

2. **Elective Courses (15) Credit Hours: from the following:**

Course No.	Course Title	Credit Hrs	Theory	Practical	Pre/Co-requisite
0333911	Spectrophotometric Methods of Analysis	3			-
0303942	Statistical Thermodynamics	3			-
0333943	Nanochemistry	3			-
0303991	Advanced Analytical Chemistry	3			-
0303992	Advanced Inorganic Chemistry	3			-
0303993	Advanced Organic Chemistry	3			-
0303994	Advanced Physical Chemistry	3			-
1201710	Medicinal Chemistry	3			-
1201908	Medicinal Natural Products	3			-

3. Pass the qualifying exam (0333998).

4. Thesis: (0333999) Credit hours (**18**).

Course Description

0333911 **Spectrophotometric methods of Analysis** **(3 Credit Hrs)**
Prerequisite: (None)
Spectrophotometric methods and their applications. Recent advances in spectrophotometric methods such as photoacoustic spectroscopy, and applications of lasers and plasma in chemical analysis.

0303912 **Electrochemical Methods of Analysis** **(3 Credit Hrs)**
Prerequisite: (None)
Thermodynamics of electrochemical reactions, kinetics of chemical reactions, mass transfer, electrode processes, potentiometry, electrogravimetry, coulometry, chronoamperometry, chronocoulometry polarography, stripping analysis, ultramicroelectrodes, hydrodynamic techniques, modified electrodes, spectroelectrochemistry.

0333913 **Advanced Chromatography** **(3 Credit Hrs)**
Prerequisite: (None)
Multidimensional analysis, electroseparations, solid phase separation techniques, innovations in HPLC techniques and instrumentation, innovations in GC techniques and instrumentation, hyphenated techniques, advanced applications such as chiral separations.

0333921 **Organometallic Chemistry** **(3 Credit Hrs)**
Prerequisite: (None)
The chemistry and physico-chemical properties of organometallic compounds of lanthanides and actinides. Molecular and electronic structures using X-ray cyrstal structure determination and spectroscopy. Thermochemistry and catalysis using organometallics.

0333932 **Synthetic Organic Chemistry** **(3 Credit Hrs)**

Prerequisite: (None)

Planning organic synthesis. Disconnection and retrosynthesis approach. Functional groups interconversions. Carbon-carbon bond forming reactions: enolates, enamines, yields, organometallics, cyclization, annulation, and cycloaddition reactions. Stereochemistry and asymmetric synthesis. Supramolecular chemistry. Examples on total synthesis of naturally occurring compounds.

0303933 **Natural products Chemistry** **(3 Credit Hrs)**

Prerequisite: (None)

Study of the structure, biosynthesis and identification of secondary metabolites such as alkaloids, terpenoids and aliphatic and aromatic compounds with emphasis on biologically active substances and their synthesis.

0333941 **Applications in Quantum Chemistry** **(3 Credit Hrs)**

Prerequisite: (None)

Methods of modern quantum chemistry and current computational techniques, molecular orbital theory, semi-empirical and abinitio computational techniques, applications involving the electronic and molecular structure of molecules, physical and chemical properties, calculations of potential energy surfaces, applications in molecular electronic spectroscopy and nuclear magnetic resonance (NMR) spectroscopy.

0303942 **Statistical Thermodynamics** **(3 Credit Hrs)**

Prerequisite: (None)

Basic concepts in probability and statistics, introduction to statistical quantum mechanics, statistical thermodynamics and applications to ideal systems, applications to systems of independent particles. systems involving intermolecular interactions, quantum statistics.

0333943 **Nanochemistry** **(3 Credit Hrs)**

Prerequisite: (None)

Fundamentals of nanomaterials formation, nanochemistry basics, layer-by-layer self-asembly, synthesis and self-assembly of nano materials, nanocluster self-assembly, self-assembling block copolymers, self-assembly of large building blocks, nanochemistry and nanolabs, properties and applications of nanomaterials, scanning probe microscopy techniques.

0333961 **Seminar** **(3 Credit Hrs)**

Prerequisite: (None)

The student will do a literature survey on a special subject which is different from his Ph.D. subject. The student will give a lecture in front of faculty members and students.

0303991 **Advanced Analytical Chemistry** **(3 Credit Hrs)**

Prerequisite: (None)

This course will cover the most recent progress in analytical chromatography, analytical spectroscopy and analytical electrochemistry.

0303992 **Advanced Inorganic Chemistry** **(3 Credit Hrs)**

Prerequisite: (None)

Aquatic chemistry: complexation, absorption, adsorption and desorption. Marine chemistry: models and cycles of ions and molecules in lakes, seas and oceans. Soil chemistry: organic and inorganic components. Pollution with organic and inorganic compounds. Migration of ions and molecules.

0303993 **Advanced Organic Chemistry** **(3 Credit Hrs)**

Prerequisite: (None)

This course will deal with frontier areas in organic chemistry such as new synthetic methods, using protecting groups in synthesis, new advanced

materials, nanomaterials, functional polymers, protecting groups .... etc.

0303994 Advanced Physical Chemistry (3 Credit Hrs)

Prerequisite: (None)

This course will cover classical and statistical thermodynamics, chemical kinetics and other selected topics in physical chemistry. Students will study methods and underlying principles of chemical thermodynamics and kinetics, most recent advances in surface chemistry, spectroscopy and quantum mechanics.

1201710 Medicinal Chemistry (3 Credit Hrs)

Prerequisite: (None)

This course is designed to impart the knowledge in computational methods and drug design approaches. It aims to build students' knowledge in theoretical chemistry and its application in drug design. It is proposed to provide students with an understanding of hit discovery, lead identification, lead optimization, target selection, and molecular recognition employing computer-aided drug design software. And, it will shed the light on computer-based methods, combinatorial chemistry, high-throughput screening, and database mining. Additionally, different drug classes will be discussed regarding structure-activity relationship (SAR), synthesis, and metabolism.

1201908 Medicinal Natural Products (3 Credit Hrs)

Prerequisite: (None)

Some plants which form bases for some medicinal product discovery, or synthetic will be selected. Some families and species originate from different natural sources as a lead for drug discovery. Further elaboration will deal with the biosynthesis of these natural agents and the stress mechanism that leads to their existence such as environment, chemical treatment, and climate. Marine animals and plants as new and rich sources for medical agents will be covered.