

## Chemistry

### Course List

<i>Code</i>	<i>Course Title</i>	<i>Unit</i>
CHM 0410/0420	Undergraduate Seminar I/II	0/2
CHM 2120	Main Group Chemistry	2
CHM 2850	Inorganic Chemistry Laboratory I	2
CHM 2200	Basic Principles and Hydrocarbons	3
CHM 2820	Organic Chemistry Laboratory I	2
*CHM 2250	Basic Organic Chemistry	3
*CHM 2870	Basic Organic Chemistry Laboratory	1
CHM 2300	Thermodynamics and Chemical Equilibrium	2
CHM 2830	Physical Chemistry Laboratory I	2
CHM 2320	Fundamentals of Spectroscopic Analysis	2
CHM 2330	Tools in Physical Chemistry	3
CHM 2380	Chemical Safety and Practice	2
CHM 2400	Analytical Chemistry	2
CHM 2408	Analytical Chemistry Laboratory I	2
CHM 3130	Transition Metal Chemistry	3
CHM 3860	Inorganic Chemistry Laboratory II	2
CHM 3220	Alcohols, Ethers and Carbonyl Compounds	2
CHM 3230	Amines, Arenes and Heterocycles	2
CHM 3810/3820	Organic Chemistry Laboratory II/III	2/2
CHM 3310	Chemical Bonding	2
CHM 3320	Chemical Kinetics	2
CHM 3830	Physical Chemistry Laboratory II	2
CHM 3410	Instrumental Analysis	3
CHM 3870	Analytical Chemistry Laboratory II	2
CHM 4100	Advanced Inorganic Chemistry	3
CHM 4200	Pericyclic Reactions and Biomolecules	2
CHM 4830	Organic Chemistry Laboratory IV	1
CHM 4330	Molecular Spectroscopy	2
CHM 4820	Physical Chemistry Laboratory III	2
CHM 4840	Physical Chemistry Laboratory IV	1
CHM 4400	Advanced Analytical Chemistry	2
CHM 4870	Analytical Chemistry Laboratory III	1
CHM 4480/4490	Undergraduate Special Project I/II	1/1
CHM 4980/4990	Undergraduate Thesis I/II	2/2
CHM 5080	Introduction to Macromolecules	2
CHM 5710	Quantum Chemistry	2

\* Courses offered in 2002-03 and before.

The following elective courses are offered to graduate students in the Chemistry Division and undergraduates in the Chemistry programme in their final year of attendance. Topics offered each year are to be decided by the Department on selective basis.

#CHM 4030	Polymer Science	2
CHM 4430	Practices in Testing Laboratory	2
CHM 5040	Organic Polymer Chemistry	2
CHM 5510	Inorganic Reaction Mechanisms	2
CHM 5520	Physical Methods in Inorganic Chemistry	2
CHM 5530	Organometallic Chemistry	2
CHM 5540	Bioinorganic Chemistry	2
CHM 5550	Organolanthanide Chemistry	2
CHM 5620	Synthetic Methods in Organic Chemistry	2
CHM 5630	Synthesis of Natural Products	2
CHM 5650	Bioorganic Chemistry	2
CHM 5720	Molecular Modelling	2
CHM 5730	Special Topics in Chemistry	2
CHM 5740	Advanced Chemical Kinetics	2
CHM 5750	Surface and Interface Analysis	2
CHM 5760	X-ray Crystallography	2
CHM 5780	Mass Spectrometry of Biomolecules	2
CHM 5781	Advanced NMR Spectroscopy	2
CHM 5782	Principles of Biomolecular NMR Spectroscopy	2
CHM 5783	Introduction to Laser Spectroscopy	2
CHM 5910	Current Topics in Chemistry	2

### Course Description

CHM 0410/0420

Undergraduate Seminar I/II

0/2 U; 1 STOT; 2-term

Oral and written reports on important topics from the current chemical literature.

CHM 2120

Main Group Chemistry

2 U; 2 Lect.; 1st term

Acid-base chemistry. Chemistry in aqueous and non-aqueous solutions. Chemistry of non-transition elements. Periodicity.

CHM 2850

Inorganic Chemistry Laboratory I

2 U; 4 Lab.; 1st term

To be taken in conjunction with CHM 2120. Laboratory work covers inorganic synthesis, modern techniques of analysis, and experiments designed to illustrate the theoretical principles.

CHM 2200

Basic Principles and Hydrocarbons

3 U; 3 Lect. 1 Tut.; 2nd term

Fundamental concepts in structure, chemical bonding, stereochemistry and physical properties of carbon compounds. Preparations, physical properties, and chemical reactions of aliphatic hydrocarbons, alkyl halides and aromatic compounds.

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# *Course not to be taken by graduate students from 2001-02.*

**CHM 2820**

## Organic Chemistry Laboratory I

2 U; 4 Lab.; 2nd term

To be taken in conjunction with CHM 2200. Laboratory work covers basic techniques in organic chemistry.

**CHM 2300**

## Thermodynamics and Chemical Equilibrium

2 U; 2 Lect.; 2nd term

The laws of thermodynamics. Free energy. Equilibrium constant. Equilibrium constraints. Electrochemical equilibria. Ionic equilibria. Biochemical applications.

**CHM 2830**

## Physical Chemistry Laboratory I

2 U; 4 Lab.; 2nd term

To be taken in conjunction with CHM 2300. This course attempts to acquaint the students with the basic principles of thermodynamics and their applications.

**CHM 2320**

## Fundamentals of Spectroscopic Analysis

2 U; 2 Lect. 1 Tut.; 2nd term

An introduction to the basic principles of various spectroscopic methods and their applications for the identification of chemical compounds.

**CHM 2330**

## Tools in Physical Chemistry

3 U; 3 Lect. 1 Tut.; 1st term

Mathematical functions frequently used in chemistry. The limiting process. Rates of change and differentiation. Location of maximum, minimum and saddle points and their relation to stable and transition structures in chemical reactions. Power series and its application in spectroscopy. Integration techniques used in kinetics. Systems of linear equations and their applications in molecular orbital theory.

**CHM 2380**

## Chemical Safety and Practice

2 U; 2 Lect.; 1st term

Topics covered in this course: international chemical safety regulations and basic principles; local and PRC regulations related to chemical safety; MSDS, safety equipment, storage, transportation, disposal and emergency.

**CHM 2400**

## Analytical Chemistry

2 U; 2 Lect. 0.5 Exer.; 1st term

Treatment of analytical data. Gravimetric analysis. Titrimetric analysis. Electrochemistry and its analytical methods.

**CHM 2408**

## Analytical Chemistry Laboratory I

2 U; 4 Lab.; 1st term

To be taken in conjunction with CHM 2400. It includes experiments in gravimetric, volumetric titration and some basic instrumental methods.

CHM 3130

Transition Metal Chemistry

3 U; 3 Lect. 1 Tut.; 2nd term

Continuation of CHM 2120. Co-ordination chemistry: bonding, structure, reaction kinetics and mechanisms. Chemistry of the transition elements, the lanthanides, actinides and the transactinide elements.

CHM 3860

Inorganic Chemistry Laboratory II

2 U; 4 Lab.; 2nd term

To be taken in conjunction with CHM 3130. Laboratory work covers inorganic synthesis, modern techniques of analysis, and experiments designed to illustrate the theoretical principles.

CHM 3220

Alcohols, Ethers and Carbonyl Compounds

2 U; 2 Lect.; 1st term

Continuation of CHM 2200. Chemistry of alcohols, phenols, ethers, epoxides, aldehydes and ketones. Enolate chemistry.

CHM 3230

Amines, Arenes and Heterocycles

2 U; 2 Lect. 1 Tut.; 2nd term

Continuation of CHM 3220. Chemistry of  $\alpha,\beta$ -unsaturated carbonyl compounds. The chemistry of carboxylic acids and functional derivatives. Amines. Aryl halides. Polynuclear aromatic and heterocyclic compounds. Macromolecules.

CHM 3810/3820

Organic Chemistry Laboratory II/III

2/2 U; 4 Lab.; 2-term

To be taken in conjunction with CHM 3220, 3230, respectively. Laboratory work consists of experiments designed to illustrate the more important procedures and techniques in organic chemistry.

CHM 3310

Chemical Bonding

2 U; 2 Lect. 1 Tut.; 1st term

Wave mechanics and electronic structure of atoms. The chemical bond. Molecular structure and symmetry.

CHM 3320

Chemical Kinetics

2 U; 2 Lect.; 1st term

Statistical mechanics and kinetic theory of gases. Treatment of molecular speeds, Maxwell-Boltzmann distribution and simple hard-sphere collision. Transport phenomena and Fick's laws. Chemical dynamics and photochemistry. Experimental kinetics and gas reactions. Kinetics in the liquid phase.

CHM 3830

Physical Chemistry Laboratory II

2 U; 4 Lab.; 1st term

To be taken in conjunction with CHM 3320. The practical work deals with the application of principles covered in the lectures.

## CHM 3410

## Instrumental Analysis

3 U; 3 Lect. 1 Tut.; 1st term

Spectrophotometric methods including atomic absorption and emission, x-ray fluorescence, infrared and ultraviolet visible spectroscopies. Chromatographic separation methods and mass spectrometry.

## CHM 3870

## Analytical Chemistry Laboratory II

2 U; 4 Lab.; 1st term

To be taken in conjunction with CHM 3410. Some illustrative experiments related to the lectures of CHM 3410 to enable students to have some experience in using the modern analytical instruments for chemical analyses.

## CHM 4100

## Advanced Inorganic Chemistry

3 U; 3 Lect. 1 Tut.; 1st term

Continuation of CHM 3130. Group theory and its applications in chemistry. Topics which can be fruitfully treated by group theory include chemical bonding, molecular vibration, electronic spectra of transition metal complexes, cluster compounds and the structure of crystals.

## CHM 4200

## Pericyclic Reactions and Biomolecules

2 U; 2 Lect.; 2nd term

Continuation of CHM 3220, 3230. Discussion of conservation of orbital symmetry and two or more of the following topics: the chemistry of carbohydrates; physical organic chemistry; organometallic compounds in organic synthesis; general principles of organic synthesis; free-radical chemistry; biosynthesis.

## CHM 4830

## Organic Chemistry Laboratory IV

1 U; 4 Lab./fortnight; 2nd term

Laboratory work involving more advanced and/or project-oriented experiments in organic chemistry.

## CHM 4330

## Molecular Spectroscopy

2 U; 2 Lect. 1 Tut.; 1st term

Introduction of molecular spectroscopy. Interactions and orders of magnitudes. Molecular structure and symmetry. Spectroscopy of molecules.

## CHM 4820

## Physical Chemistry Laboratory III

2 U; 4 Lab.; 1st term

To be taken in conjunction with CHM 4330. The practical work deals with the application of principles covered in the lectures.

## CHM 4840

## Physical Chemistry Laboratory IV

1 U; 4 Lab./fortnight; 2nd term

Laboratory work involving more advanced and/or project-oriented experiments in physical chemistry.

**CHM 4400**

Advanced Analytical Chemistry

2 U; 2 Lect. 1 Tut.; 1st term

Hyphenated techniques including GC-IR, GC-MS, LC-MS for solving specific problems in chemical analysis. Sample treatment. Analysis of real samples.

**CHM 4870**

Analytical Chemistry Laboratory III

1 U; 3 Lab.; 2nd term

To be taken in conjunction with CHM 4400. To let students have the actual practice in performing more experiments by using some more advanced instruments.

**CHM 4480/4490**

Undergraduate Special Project I/II

1/1 U; 4 Lab./fortnight or 2 Tut./week; 2-term

Research-oriented experimental work or non-experimental data collecting undertakings dealing with special chemical problems. Written approval from department to take the course is required.**CHM 5080**

Introduction to Macromolecules

2 U; 2 Lect.; 2nd term

Structure of macromolecules. Natural macromolecules. Synthesis of macromolecules. Macromolecules in solution. A brief introduction of bulk polymers.

**CHM 5710**

Quantum Chemistry

2 U; 2 Lect.; 1st term

Elements of quantum mechanics. Exactly solvable problems. Approximation methods. The Hamiltonian operator and Born-Oppenheimer approximation. Pauli's Exclusion Principle and the Slater determinants, the calculation of one-center and two-center integrals with Slater determinants, and the Coulomb and exchange integrals. Averaged field for electron interactions and the self-consistent method. Linear combination of atomic orbitals, the variation principle and the Hartree-Fock equation. Gaussian orbitals. Density functional theory.

## Study Scheme

### I. Major Programme

Students are required to complete a minimum of 69 units of courses as follows:

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|------|---|----------|
| (i)  | Required Courses (Please see Notes):  | 63 units |
|      | CHM 0410/0420, 2120, 2200, 2300, 2320, 2330, 2380, 2400, 2408, 2820, 2830, 2850, 3130, 3220, 3230, 3310, 3320, 3410, 3810/3820, 3830, 3860, 3870, 4330, 4820 plus at least **three combinations from CHM 4100, 4200/4830, 5080 or 5710 with 4840, and 4400/4870 |          |
| (ii) | Elective Courses:   | 6 units  |
|      | CHM 4030, 4430, 5040, 5510, 5520, 5530, 5540, 5550, 5620, 5630, 5650, 5720, 5730, 5740, 5750, 5760, 5780, 5781, 5782, 5783, 5910  |          |

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Total: 69 units

\*\* *Apart from CHM 4100, remaining lecture courses may be counted as elective courses in the final year of studies (excluding corresponding laboratory courses) if a student selects to take more than three from CHM 4200, 4400, 5080 or 5710.*

**Recommended course pattern**

<i>First Year of Attendance</i>	24 units
CHM 2120/2850, 2200/2820, 2300/2830, 2320, 2330, 2380, 2400/2408	
<i>Second Year of Attendance</i>	24 units
CHM 3130, 3860, 3410, 3870, 3220, 3230, 3810/3820, 3310, 3320, 3830	
<i>Third Year of Attendance</i>	21 units
CHM 0410/0420, 4330, 4820, at least three combinations from CHM 4100, 4200/4830, 5080 or 5710/4840, 4400/4870	
AND 6 units from the elective courses	

Total: 69 units

- Notes: 1. Students should obtain Grade "D" or above in each of the courses of CHM 2120/2850, 2200/2820, 2300/2830, 2320, 2330, 2380 and 2400/2408. Otherwise, they are required to repeat the courses. Students who cannot meet the Grade "D" requirement in any one of the courses mentioned above after two attempts will be required to withdraw from the University. Please refer to Reg. 15.2(d) of the General Regulations Governing Full-time Undergraduate Studies.
2. A student may, subject to approval by the Department, select CHM 4980/4990, and submit an undergraduate thesis in place of one elective and two units of third-year laboratory courses from CHM 4820, 4830, 4840, 4870 in his final year of attendance.
3. A student in the final year of attendance may, under special circumstances and with written approval by the Department, select CHM 4480 and/or 4490 to substitute up to two units of any lecture or laboratory courses in Chemistry Major Programme.

2. *Minor Programme*

**A. Applicable to students admitted in 2003-04 and thereafter**

Students are required to complete a minimum of 21 units of courses including: CHM 2120/2850, 2200, 2400/2408, 3220/3810, CMS 2822 and at least five units from CHM 2330, 3320, 3410, ENS 4525, 4535

**B. Applicable to students admitted in 2002-03 and before**

Students are required to complete a minimum of 21 units of courses including: CHM 2120/2850, 2400/2408, 3220/3810, either CHM 2250/2870 or 2200 and CMS 2822, and at least five units from CHM 2330, 3320, 3410, ENS 4525, 4535

3. *Faculty Language Requirement*

(Please refer to the "Faculty Language Requirement" of Faculty of Science for details.)