Chemistry

Chemistry is the scientific discipline that describes, from both an experimental and a theoretical perspective, the properties and reactions of all of the elements and all of their compounds (the material 'stuff' of the universe). As such, it is of fundamental importance in the physical, biological, and general sciences. Chemistry is responsible for and sustains life on Earth, has played a pivotal role in 'the ascent of man', is an absolute requirement of modern technological societies, and is a key science of the future. A sound training in chemistry is essential for employment and advancement in scientific and allied careers in teaching, research, government, the professions, health and environmental regulation, commerce, and industry.

The School of Chemistry offers theory and practical courses in chemistry which are designed to teach:

- a general understanding of the structure and properties of matter;
- the relationships between structure, properties and chemical reactivity;
- control of chemical reactions (kinetics, energetics, chemical design and synthesis);
- the role of chemistry and chemical processes in the natural world;
- the role of chemistry and chemical technology in the industrialised world; and
- an appreciation of the health, safety and environmental issues associated with chemistry.

Students can undertake a three or four-year program in chemistry leading to a degree major in the subject or enrol in a limited selection of subjects to suit their goals and interests. Graduates with a major in chemistry are eligible for membership of the Royal Australian Chemical Institute, the peak professional body for chemists in Australia, as well as chemical societies from around the world.

Overview of subjects

100-level subjects

There are two 100-level chemistry streams for students who have completed VCE or its equivalent. Each consists of two semester-length subjects, Chemistry 610-121 plus 610-122 (Semesters 1 and 2), and 610-141 plus 610-142 (which is offered in Semesters 1 and 2, or Semester 2 and Summer Semester).

- 610-121 plus 610-122 Chemistry is an advanced stream suited to students with a very strong background in chemistry. This subject will provide an advanced treatment of chemistry which is appropriate for students who intend to major in chemistry or the physical or biological sciences. The course is presented using traditional lecture/tutorial platforms augmented by computer-aided learning (CAL) and laboratory programs. This stream is offered in Semesters 1 and 2.
- 610-141 plus 610-142 Chemistry is designed to provide the essential chemistry required to major in chemistry or the physical or biological sciences. VCE Chemistry or its equivalent is normally a prerequisite for this subject. The course is presented using traditional lecture/tutorial platforms augmented by computer-aided learning (CAL) and laboratory programs. This stream is offered twice during the year, once over Semesters 1 and 2, then again over Semester 2 and Summer Semester.

For students who have not completed VCE Chemistry or its equivalent the subject Chemistry 610-171 is available.

- 610-171 Fundamentals of Chemistry is designed to cater for students who have not completed VCE Chemistry and is offered in Semester 1. The subject is presented using traditional lecture/tutorial platforms augmented by computer-aided learning (CAL) and laboratory programs. This subject is designed to provide background knowledge in chemistry to allow students to enter Chemistry 610-141 in Semester 2. Students who achieve a high level of performance in the examination component of Chemistry 610-171 may be permitted to undertake Chemistry 610-142 in Semester 2 or Summer Semester provided they also complete additional computer-aided learning tasks during the winter recess break.

Notes:

- Students with a high level of performance in VCE Physics and Mathematics who have not completed VCE Chemistry may be permitted to enrol in Chemistry 610-141. Contact the the Director of First Year Studies, Assoc Prof WD McFadyen, for further information.
- Students with a high level of achievement in chemistry at Year 12 or its equivalent may apply for direct entry into 200-level chemistry subjects. Contact the Director of First Year Studies, Assoc Prof WD McFadyen, for information regarding exemption examinations.
- Students who have gained credit for 610-051 and 610-052 (available only to BBiomedSc students) are eligible to enrol in 200-level chemistry subjects.
- Credit is available for one only of 610-121 or 610-141 or 610-051, and for one only of 610-122 or 610-142 or 610-052.

200-level subjects

The School of Chemistry offers a selection of subjects at the 200-level. These subjects all reinforce the basic principles introduced in 100-level subjects and extend further to a more sophisticated treatment of the chemical sciences. Theory, practical and combined theory/practical courses in the main areas of chemistry are offered.

300-level subjects

At the 300-level, theory, practical and combined theory/practical courses continue the development of the main areas of chemistry. Students intending to continue to BSc (Hons) in chemistry should note that they are strongly recommended to enrol in at least 62.5 points of 300-level chemistry. The Chemical Research Project is a recommended feature of the 300-level course.

Suggested subjects

The following broad guidelines relate to students majoring in chemistry:

100-level subjects

Along with one of the 100-level chemistry streams, students are recommended to take mathematics and statistics 620-121 plus 620-123 or 620-141 plus 620-143 or 620-160 plus 620-161. Additional 100-level subjects should be selected from physics, biology, earth sciences, mathematics and statistics, or computer science. Students intending to enrol in 610-211 Light, Matter & Chemical Change B *(p.3)* should note that 100-level mathematics and physics are recommended.

200-level subjects

At 200-level, chemistry 610-210, 610-220, 610-240 and 610-260 provide a minimum grounding in the important areas of physical, organic, inorganic and analytical/spectroscopic chemistry, respectively. These subjects combine theory and practical components in a single unit of 12.5 points. More comprehensive training in the areas of physical, organic and inorganic chemistry is provided by the following pairs of theory and practical units, each totalling 18.75 points, viz. 610-211 plus 610-215; 610-221 plus 610-225; and 610-241 plus 610-245. Students with a well-developed interest in particular areas are encouraged to enrol in the larger joint subjects which reflect their goals and interests. Environmental Chemistry 610-280 is available to students pursuing environmental science and chemistry.

Students majoring in chemistry should enrol in at least 37.5 points of 200-level chemistry; this can be achieved by various subject combinations. Selections must include at least three of the subjects 610-210 (or 610-211 plus 610-215), 610-220 (or 610-221 plus 610-225), 610-240 (or 610-241 plus 610-245), and 610-260 (or 610-280). Students with a broad interest in chemistry may elect to enrol in all of 610-210, 610-220, 610-240 and 610-260, whereas students with a well-developed interest in particular areas may elect to enrol in one or more of 610-211 plus 610-215; 610-221 plus 610-225; and 610-241 plus 610-245; and other subjects up to at least 50 points. Students with a particularly strong interest in chemistry may of course enrol in subjects totalling 50 points or more.

300-level subjects

The flexible structure of the 200-level courses is maintained at the 300-level. The subjects 610-310, 610-320 and 610-340 provide a minimum grounding in the important areas of physical, organic and inorganic chemistry, respectively. These subjects combine theory and practical components in a single unit of 12.5 points. A more in-depth treatment of these three areas is provided by the following pairs of theory and practical subjects, each totalling 18.75 points, viz. 610-311 plus 610-315; 610-321 plus 610-325; and 610-341 plus 610-345. Students wishing to specialise in particular areas are encouraged to enrol in the larger joint subjects. Specialist subjects in bio-organic chemistry, molecular technology and processes, and analytical and environmental chemistry are also available (610-332, 610-333 and 610-360, respectively). The Chemistry Research Project 610-399 is strongly recommended for students intending to enrol in the honours program in chemistry.

Students majoring in chemistry should refer to the prescribed structure of the major, see page 12.

It is recommended that students intending to major in chemistry also undertake the Research Project 610-399. Student with a particularly strong interest in chemistry may of course enrol in units totalling more than 50 points.

Special requirements for laboratory classes

For all laboratory classes in 100- to 400-level chemistry students are required to wear a standard laboratory coat, approved safety glasses or goggles, and approved footwear. Thongs and sandals are not permitted in laboratories.

Bachelor of Science (Degree with Honours)

The School of Chemistry offers a fourth-year honours program to eligible students. The Honours year involves course work and the completion of a research project under the supervision of one or more staff members. Honours graduates are eligible for membership of the Royal Australian Chemical Institute and chemical societies from around the world. Please refer to *Bachelor of Science (Degree with Honours) and Bachelor of Information Systems (Degree with Honours) (p.1)*.

Further information

School of Chemistry
The University of Melbourne
Victoria 3010
Tel: +61 3 8344 7137
Fax: +61 3 9347 5180

Web: http://www.chemistry.unimelb.edu.au

Subject descriptions

Special Requirements: For all chemistry 100-level subjects: an A4 duplicate notebook; access to a calculator and sets of molecular models is recommended.

100-level subjects

610-141 Chemistry A

Note: Credit cannot be gained for this subject and 610-121, 610-161 or 610-051.

Credit points: 12.5

Coordinator: Dr B Abrahams

Prerequisites: VCE Chemistry.

Contact: 36 lectures (three per week), 25 hours of practical work, 12 hours tutorials, 6 hours problem-solving/computer-aided learning *(Semester 1, repeat 2).*

Description: Upon completion of 610-141, students should have an understanding of the place of chemistry in society and the physical environment; the nature of gases; basic energy concepts; the nature of chemical equilibria; the structure and bonding of inorganic molecules; the nature of the solid state; the structures of hydrocarbon and main group molecules; the important functional groups; the nature of techniques of measurement; and the evolution of current theories.

In the practical component, students should develop basic laboratory skills (observation, analytical techniques, report writing); oral communication skills; independent learning skills; and an appreciation of the health and safety issues associated with the safe handling and disposal of laboratory chemicals.

The subject provides an introduction to stoichiometry; gases; energy (enthalpy and thermochemistry); chemical equilibrium; acid-base chemistry; aspects of main group chemistry: structure and bonding in elements and compounds of groups 14-18; solutions and pH equilibria; intermolecular forces and extended solid state structures; structure and bonding of alkanes, alkenes and alkynes; benzene and its derivatives; functional groups; and spectroscopy and determination of structure.

Assessment: A 30-minute written class test held mid-semester (5%); ongoing assessment of practical work throughout the semester (20%); a 3-hour written examination in the examination period (75%). Satisfactory completion of practical work is necessary to pass the subject.

Prescribed texts: S Zumdahl, *Chemical Principles*, 5th edn, Houghton Mifflin, 2005. • J McMurry, *Organic Chemistry*, 6th edn, Thomson Brooks/Cole, 2004.

610-142 Chemistry B

Note: Credit cannot be gained for this subject and 610-122, 610-162 or 610-052.

Credit points: 12.5

Coordinator: Dr B Abrahams

Prerequisites: Chemistry 610-141, 610-161 or 610-121. Students with a high level of achievement in 610-171 or 202-101 may be permitted to enrol in 610-142 upon successful completion of the chemistry 610-141 computer-aided learning modules during the winter recess.

Contact: In Semester 2: 36 lectures (three per week), 25 hours of practical work, 12 hours tutorials, 6 hours problem-solving/computer-aided learning. In Summer Semester presented over a six week period: 36 lectures (six per week), 25 hours of practical work, 12 hours tutorials, 6 hours problem-solving/computer-aided learning *(Semester 2, repeat Summer).*

Description: On completion of 610-142, the student should have an understanding of the reactivity of organic molecules; the nature of chemical change; the structure of the atom; and the structure and reactivity of metal compounds.

In the practical component, students should develop basic laboratory skills (observation, analytical techniques, report writing); oral communication skills; independent learning skills; an appreciation of the health and safety issues associated with the safe handling and disposal of laboratory chemicals.

The subject provides an introduction to organic acids and bases; nucleophilic substitution reactions; elimination reactions; addition reactions; electrophilic aromatic substitution reactions; nucleophilic addition reactions; organic redox reactions; chemical kinetics; atomic spectra and atomic structure; redox reactions and electrochemistry; and transition metal and coordination chemistry

Assessment: A 30-minute written class test held mid-semester (5%); ongoing assessment of practical work throughout the semester (20%); a 3-hour written examination in the examination period (75%). Satisfactory completion of practical work is necessary to pass the subject.

Prescribed texts: S Zumdahl, *Chemical Principles*, 5th edn, Houghton Mifflin, 2005. • J McMurry, *Organic Chemistry*, 6th edn, Thomson Brooks/Cole, 2004.

610-121 Chemistry A (Advanced Studies Program)

Note: Credit cannot be gained for this subject and 610-141, 610-051 or 610-161.

Credit points: 12.5

Coordinator: Dr C Hutton

Prerequisites: A high level of achievement in VCE Chemistry Units 3 and 4 or their equivalent.

Contact: 36 lectures (three per week), eight 3-hour sessions of practical work, 12 hours of tutorials and 9 hours of self-paced computer-aided learning *(Semester 1).*

Description: Upon completion of 610-121, students should have an understanding of the place of chemistry in society and the physical environment; the nature of gases; basic energy concepts; the nature of chemical change; the nature of chemical equilibria; intermolecular forces and the energetics and structures of solid state materials; the structure and bonding of main group elements and their important compounds; the structures of hydrocarbon and main group molecules; the important functional groups; spectroscopic identification of organic compounds; the nature of techniques of measurement; and the evolution of current theories.

In the practical component, students should develop basic laboratory skills (observation, analytical techniques, report writing); oral communication skills; independent learning skills; an appreciation of the importance of instrumental methods in chemistry; and an appreciation of the health and safety issues associated with the safe handling and disposal of laboratory chemicals.

The subject provides an introduction to gases, real and ideal; thermodynamics; energy, enthalpy, entropy; chemical equilibrium; homogeneous and heterogeneous equilibrium calculations; the structure and bonding of main group elements and their important compounds; reactions involving solubility; pH equilibria and acid-base chemistry; molecular structure and bonding in alkanes, alkenes, alkynes and aromatics; organic nomenclature; stereochemistry; functional groups; and methods in spectroscopic identification of organic compounds.

Assessment: Two 30-minute written class tests held during the semester (20%); ongoing assessment of practical work throughout the semester (20%); a 2-hour written examination in the examination period (60%). Satisfactory completion of practical work is necessary to pass the subject.

Prescribed texts: S Zumdahl, *Chemical Principles*, 5th edn, Houghton Mifflin, 2005. • J McMurry, *Organic Chemistry*, 6th edn, Thomson Brooks/Cole, 2004.

610-122 Chemistry B (Advanced Studies Program)

Note: Credit cannot be gained for this subject and 610-142, 610-162 or 610-052

Credit points: 12.5

Coordinator: Dr C Hutton

Prerequisites: Chemistry 610-121.

Contact: 36 lectures (three per week), eight 3-hour sessions practical work, 12 hours of tutorials, 9 hours self-paced computer-aided learning *(Semester 2).*

Description: On completion of 610-122, the student should have an understanding of chemical transformation of organic compounds; reaction mechanisms; atomic structure; organic chemical synthesis; and the structure and bonding of transition elements and their important compounds. In the practical component students should develop basic laboratory skills (observation, analytical techniques; report writing); oral communication skills; independent

learning skills; appreciation of the importance of instrumental methods in chemistry; and an appreciation of the health and safety issues associated with the safe handling and disposal of laboratory chemicals.

The subject provides an introduction to physical properties and chemical reactions of organic compounds; reaction mechanisms and chemical equilibria; organic acids and bases; nucleophilic substitution (SN1 and SN2); elimination reactions (E1 and E2); electrophilic addition to alkenes; electrophilic aromatic substitution; nucleophilic addition and substitution to carbonyls; oxidation and reduction; radical addition, substitution and polymerisation reactions; chemical kinetics; atomic spectra and atomic structure; the wave nature of matter; the Schrodinger equation; the structure and bonding of transition elements and their important compounds; redox reactions (reduction/oxidation); the chemical, technological and analytical applications of electrochemistry; and the structure, applications and biological roles of transition metal coordination compounds.

Assessment: Two 30-minute written class tests held during the semester (20%); ongoing assessment of practical work throughout the semester (20%); a 2-hour written examination in the examination period (60%). Satisfactory completion of practical work is necessary to pass the subject.

Prescribed texts: S Zumdahl, *Chemical Principles*, 5th edn, Houghton Mifflin, 2005. • J McMurry, *Organic Chemistry*, 6th edn, Thomson Brooks/Cole, 2004.

610-171 Fundamentals of Chemistry

Note: Students intending to undertake chemistry 610-142 in order to meet prerequisites for later year chemistry or biochemistry subjects must achieve at a high level in the examination component of this subject. The chemistry sequence of 610-141 and 610-142 is available for students who have completed VCE Chemistry. Students will not be permitted to enrol in chemistry 610-171 if they have already completed chemistry 610-121, chemistry 610-141, chemistry 610-051 or equivalent studies.

Credit points: 12.5

Coordinator: A/Prof P Tregloan

Prerequisites: Some knowledge of basic science will be assumed.

Contact: Thirty-six lectures (three per week), six 3-hour sessions of practical work, 12 hours of tutorials, 6 hours of computer-aided learning *(Semester 1).*

Description: On completion, the student should have an understanding of the nature of matter, solutions and gases, the chemical change related to equilibrium, energy and kinetics, and the nature of redox processes; and structures and functional groups in organic molecules.

In the practical component, students should develop basic laboratory skills (observation, analytical techniques, report writing) and an appreciation of the health and safety issues associated with the safe handling and disposal of laboratory chemicals.

The subject provides an introduction to the nature of matter: elements, atoms, ions and molecules; the electronic structure of atoms and ions; bond formation, including covalent, ionic, metallic, hydrogen bonding, and van der Waals; solubility and the solution state; ions and hydration; the behaviour of gases; the mole concept; concentrations; stoichiometry; acids, bases, neutralisation reactions and salt formation; acid/base strength and the pH scale; energy and chemical systems; rates of reaction and reaction order; catalysis and enzymes; chemical equilibrium; the equilibrium constant, Ka, Kb, stability constants and solubility products; redox reactions and redox potentials; organic molecules: structure, nomenclature and functional groups; hydrophobicity and hydrophilicity; and biologically significant macromolecules.

This subject will provide the student with the opportunity to establish and develop the following generic skills: the ability to use conceptual models and gather and rationalise data, problem-solving and critical thinking.

Assessment: Three 30-minute 'take home' tests held during the semester (15%); ongoing assessment of practical work throughout the semester (20%); a 3-hour written examination in the examination period (65%). Satisfactory completion of practical work is necessary to pass the subject.

Prescribed texts: SS Zumdahl and SA Zumdahl, *Chemistry*, 6th edn, Houghton Mifflin, 2003.

200-level subjects

610-210 Light, Matter & Chemical Change A

Note: Credit cannot be gained for this subject and 610-211 or 610-215.

Credit points: 12.5

Coordinator: A/Prof M L Gee

Prerequisites: One of chemistry 610-141, 610-121 or 610-051 plus one of 610-142, 610-122 or 610-052. 100-level mathematics and 100-level physics are recommended.

Contact: 24 lectures (three per week for eight weeks), eight tutorials and 30 hours of practical work *(Semester 2).*

Description: Upon completion of 610-210, students should have an appreciation for the rates and mechanisms of enzyme catalysed reactions and environmentally significant atmospheric processes; understand the concepts of entropy and free energy and their application to chemical and biological systems; understand the interactions between molecules and light and the use of light in the determination of molecular structure; and have developed experimental skills in the operation of instrumentation for the acquisition of physical data, as well as observational and critical analysis skills for the interpretation and presentation of data.

The subject covers the dynamics of molecular processes; energy transformation and storage in chemical and biological systems; and the interaction between molecules and light, and its relationship to molecular structure. The practical course will consist of experiments involving physical and instrumental investigations of important chemical systems and phenomena.

Assessment: Ongoing assessment of practical work in the form of short reports throughout the semester (25%); written assignments and class tests during the semester (10%); a 3-hour written examination in the examination period (65%). Satisfactory completion of practical work is necessary to pass the subject.

Prescribed texts: PW Atkins, *Physical Chemistry*, 6th edn, OUP, 1998.

610-211 Light, Matter & Chemical Change B

Note: Credit cannot be gained for this subject and 610-210.

Credit points: 12.5

Coordinator: A/Prof M L Gee

Prerequisites: One of chemistry 610-141, 610-121 or 610-051 plus one of 610-142, 610-122 or 610-052. 100-level mathematics and 100-level physics are recommended. Concurrent enrolment in 610-215 is strongly recommended.

Contact: 36 lectures and 12 tutorials *(Semester 2).*

Description: Upon completion of 610-211, students should have an appreciation for the rates and mechanisms of enzyme catalysed reactions and environmentally significant atmospheric processes; understand the concepts of entropy and free energy and their application to chemical and biological systems; understand the interactions between molecules and light and its use in the determination of molecular structure; and understand modern views of molecular structure and the interaction of light with matter and its chemical consequences.

The subject covers the dynamics of molecular processes; energy transformation and storage in chemical and biological systems; the interaction between molecules and light and its relationship to molecular structure; and molecular structure and the harnessing of energy by absorption of light.

Assessment: Written assignments not exceeding 30 pages due during the semester (15%); a 3-hour written examination in the examination period (85%).

Prescribed texts: PW Atkins, *Physical Chemistry*, 5th edn, OUP, 1994.

610-215 Physical Chemistry Practical II

Note: Credit cannot be gained for this subject and 610-210.

Credit points: 6.25

Coordinator: A/Prof M L Gee

Prerequisites: One of chemistry 610-141, 610-121 or 610-051 plus one of 610-142, 610-122 or 610-052. Concurrent enrolment in 610-211 is strongly recommended.

Contact: 36 hours of practical work *(Semester 2).*

Description: Upon completion of 610-215, students should have developed experimental skills in the operation of instrumentation for the acquisition of physical data, as well as observational and critical analysis skills for the interpretation and presentation of data.

The subject will consist of a number of experiments involving physical and instrumental investigations of important chemical systems and phenomena.

Assessment: Ongoing assessment of practical work in the form of short reports due during the semester (100%).

610-220 Organic Chemistry

Note: Credit cannot be gained for this subject and 610-221 or 610-225.

Credit points: 12.5

Coordinator: A/Prof J M White

Prerequisites: One of chemistry 610-141, 610-121 or 610-051 plus one of 610-142, 610-122 or 610-052.

Contact: 24 lectures (three per week for eight weeks), eight tutorials and 30 hours of practical work *(Semester 1).*

Description: Upon completion, students should have developed skills to synthesise complex organic molecules from smaller components in the laboratory; qualitative laboratory manipulative skills; and skills to record and interpret scientific observations. Students should gain an awareness of safe

and diligent laboratory practice. Students should appreciate the importance of rational, critical and independent thought in the molecular sciences and in their understanding of the chemistry of carbon compounds. Students should have an understanding of stereochemistry; the synthesis and some reactions of simple polyfunctional organic compounds, aromaticity; and the basic types of heterocyclic molecules.

The subject covers the topics molecular architecture and its relationship to chemical and biological change; the principles of organic synthesis: C-C bond formation; and the fundamentals of aromatic and heterocyclic chemistry.

The laboratory course will consist of a number of experiments involving techniques for the synthesis of important classes of organic compounds. The experiments are aimed at the exemplification of some of the lecture material.

This subject will provide the student with the opportunity to establish and develop the following generic skills: problem-solving and critical thinking skills, the ability to use conceptual models to rationalise observations, an understanding of the changing knowledge base, a capacity to articulate knowledge and understanding in written presentation, and a capacity to manage competing demands on time including self-directed work.

Assessment: Ongoing assessment of practical work in the form of short reports due during the semester (25%); a 1-hour multiple-choice examination held during the semester (10%); a 3-hour written examination in the examination period (65%). Satisfactory completion of both theory and practical work is necessary to pass the subject.

610-221 Organic & Bio-organic Chemistry

Note: Credit cannot be gained for this subject and 610-220.

Credit points: 12.5

Coordinator: A/Prof J M White

Prerequisites: One of chemistry 610-141, 610-121 or 610-051 plus one of 610-142, 610-122 or 610-052. Concurrent enrolment in 610-225 is strongly recommended.

Contact: 36 lectures and 12 tutorials *(Semester 1).*

Description: Upon completion, students should have developed an appreciation of the importance of rational, critical and independent thought in the molecular sciences and in their understanding of the chemistry of carbon compounds. Students should have an understanding of the stereochemistry of carbon compounds; the synthesis and some reactions of simple polyfunctional organic compounds, the concept of aromaticity, and the basic types of heterocyclic molecules.

The subject covers molecular architecture and its relationship to chemical and biological change; the principles of organic synthesis: C-C bond formation; the fundamentals of aromatic and heterocyclic chemistry, alkaloids, b-lactams and nucleic acid bases; and amino acids, peptides, proteins and carbohydrates.

This subject will provide the student with the opportunity to establish and develop the following generic skills: problem-solving and critical thinking skills, the ability to use conceptual models to rationalise observations, and an understanding of the changing knowledge base.

Assessment: A 1-hour multiple-choice examination held during the semester (10%); a 3-hour written examination in the examination period (90%).

Prescribed texts: J McMurry, *Organic Chemistry*, 5th edn, Brooks/Cole, 2000.

610-225 Organic Chemistry Practical

Note: Credit cannot be gained for this subject and 610-220.

Credit points: 6.25

Coordinator: A/Prof J M White

Prerequisites: One of chemistry 610-141, 610-121 or 610-051 plus one of 610-142, 610-122 or 610-052. Concurrent enrolment in 610-221 is strongly recommended.

Contact: 36 hours of practical work *(Semester 1).*

Description: Upon completion of this subject, students should have developed skills to synthesise complex organic molecules from smaller components in the laboratory; qualitative laboratory manipulative skills; and skills to record and interpret scientific observations. Students should gain an awareness of safe and diligent laboratory practice. The course should foster communication, planning and time management. Students should appreciate the importance of rational, critical and independent thought in the molecular sciences and in their understanding of the chemistry of carbon compounds. Upon completion of this subject, students should be familiar with the rational use of chemical reagents.

The subject will consist of ten experiments involving advanced techniques for the safe, systematic handling and assembly of pure organic substances. The experiments are aimed at the exemplification of some of the lecture material.

This subject will provide the student with the opportunity to establish and develop the following generic skills: problem-solving and critical thinking skills, the ability to use conceptual models to rationalise observations, a capacity to articulate knowledge and understanding in written presentation, and a capacity to manage competing demands on time including self-directed work.

Assessment: Ongoing assessment of practical work in the form of short reports due during the semester (100%).

610-240 Inorganic and Bio-inorganic Chemistry A

Note: Credit cannot be gained for this subject and 610-241 or 610-245.

Credit points: 12.5

Coordinator: A/Prof C G Young

Prerequisites: One of chemistry 610-141, 610-121 or 610-051 plus one of 610-142, 610-122 or 610-052.

Contact: 24 lectures (three per week for eight weeks), eight tutorials and 30 hours of practical work *(Semester 2).*

Description: Upon completion of 610-240, students should have an understanding of the central role of inorganic and bio-inorganic chemistry in biological systems and emerging industry processes. This subject is developed via carefully chosen examples which include the role of nature's metal-scavanging ligands; the facilitation of life by the trace metals; organometallic chemistry; and the design of catalysts in industry and nature (enzymes).

Students should also have developed skills to synthesise simple inorganic molecules, an understanding of basic analytical and spectroscopic methods, and skills to interpret and record observed chemistry.

The subject covers the occurrence, uptake and transport of the essential trace elements; metal binding in complexes; iron nutrition in humans; transport of dioxygen by hemoglobin; the action of poisons; carbon monoxide and cyanide; organometallic chemistry; hydrogen, carbon monoxide and alkenes as ligands; activation of ligands for reaction and the design of catalysts; and structural and spectroscopic techniques.

The practical component of the subject will consist of a number of experiments involving the synthesis, chemistry and instrumental investigations of important inorganic and organometallic compounds.

Assessment: Ongoing assessment of practical work in the form of short reports due during the semester (30%); a 50-minute multiple-choice examination held during the semester (7%); a 3-hour written examination in the examination period (63%). Satisfactory completion of both theory and practical work is necessary to pass the subject.

Prescribed texts: CE Housecroft and AG Sharpe, *Inorganic Chemistry*, 2nd Ed. Prentice Hall, Harlow UK 2005.

610-241 Inorganic and Bio-inorganic Chemistry B

Note: Credit cannot be gained for this subject and 610-240.

Credit points: 12.5

Coordinator: A/Prof C G Young

Prerequisites: One of Chemistry 610-141, 610-121 or 610-051 plus one of 610-142, 610-122 or 610-052. Concurrent enrolment in 610-245 is recommended.

Contact: 36 lectures and 12 tutorials *(Semester 2).*

Description: Upon completion of 610-241, students should have an understanding of the central role of inorganic and bio-inorganic chemistry in biological systems, emerging industry processes and the action of metallo-drugs. This subject is developed via carefully chosen examples which include the role of nature's metal-scavanging ligands; the facilitation of life by the trace metals; organometallic chemistry; the design of catalysts in industry and nature (enzymes); and the design and action of metal drugs.

The subject covers the occurrence, uptake and transport of the essential trace elements; metal binding in complexes; iron nutrition in humans; transport of dioxygen by hemoglobin; the action of poisons; carbon monoxide and cyanide; organometallic chemistry; hydrogen, carbon monoxide and alkenes as ligands; the activation of ligands for reaction and the design of catalysts; structural and stereoscopic techniques; metal compounds as therapeutic agents including treatments for bipolar disorder (lithium) and cancer (cis-platin); toxic overload (chelation therapy); directed sythesis; the control of stereochemistry; structural inorganic chemistry; and the structural basis of advanced materials.

Assessment: A 50-minute multiple-choice examination held during the semester (10%); a 3-hour written examination in the examination period (90%).

Prescribed texts: CE Housecroft and AG Sharpe, *Inorganic Chemistry*, 2nd Ed. Prentice Hall, Harlow UK 2005.

610-245 Inorganic Chemistry Practical

Note: Credit cannot be gained for this subject and 610-240.

Credit points: 6.25

Coordinator: A/Prof C G Young

Prerequisites: One of chemistry 610-141, 610-121 or 610-051 and one of 610-142, 610-122 or 610-052.

Contact: 36 hours of practical work *(Semester 2).*

Description: Inorganic chemistry emcompasses an enormous and diverse area of chemistry of great practical importance. This subject develops synthetic, analytical and instrumental skills in inorganic, bio-inorganic and organometallic chemistry. A wide variety of synthetic methods, handling procedures and analytical techniques are introduced.

The subject consists of the synthesis and characterisation of classes of main group, transition metal and organometallic compounds of technological and medical application. They include peroxy species, phosphates, metal-DNA complexes and metal catalysts. The metals include V, Cr, Fe, Co and Ni as well as Mo and Ru, from the second-row transition metals. These systems are investigated by infrared, NMR and UV-visible spectroscopies; by X-ray powder diffraction; and by magneto-chemistry. They are analysed by quantitative titrimetric and gravimetric techniques.

Assessment: Ongoing assessment of practical work in the form of short reports due during the semester (100%).

610-260 Analysis in Chemical and Life Sciences

Note: Credit cannot be gained for this subject and 610-285.

Credit points: 12.5

Coordinator: Dr S D Kolev

Prerequisites: One of Chemistry 610-141, 610-121 or 610-051 plus one of 610-142, 610-122 or 610-052.

Contact: 20 lectures (two per week for 10 weeks), nine tutorials and 42 hours of practical work *(Semester 1).*

Description: This subject will cover analytical methods used in research and industry for identification and determination of the elements and molecular species present in a sample, as well as physical methods used in determination of the structure of organic compounds. Methods covered will centre on atomic absorption spectrometry (AAS), infrared, ultraviolet/visible, nuclear magnetic resonance spectroscopy, and mass spectrometry. Separation and analysis methods may include liquid chromatography (HPLC), ion chromatography (IC), gas chromatography (GC and GLC) and gel electrophoresis.

The practical component of this subject should allow students to develop laboratory skills through hands-on experience with a variety of spectroscopic and analytical instruments (NMR, HPLC, GC, AAS). They will also develop skills in the interpretation of experimental data.

Upon completion of this subject, students should have acquired knowledge of analytical methods and critical thinking skills applicable across the chemical and life sciences. In particular, emphasis will be placed upon the choice and application of techniques for separation and analysis of chemical and biological materials and the development of problem-solving skills in the spectroscopic determination of molecular structure.

This subject will provide the student with the opportunity to establish and develop the following generic skills: problem-solving and critical thinking skills, the ability to use conceptual models to rationalise observations, an understanding of the changing knowledge base, a capacity to articulate knowledge and understanding in written presentation, and a capacity to manage competing demands on time including self-directed work.

Assessment: Ongoing assessment of practical work in the form of short laboratory reports due during the semester (40%); a 2-hour written examination in the examination period (60%). Satisfactory completion of both theory and practical work is necessary to pass the subject.

610-280 Environmental Chemistry

Credit points: 12.5

Coordinator: A/Prof P Mulvaney

Prerequisites: One of Chemistry 610-141, 610-121 or 610-051 plus one of 610-142, 610-122 or 610-052.

Contact: 36 lectures and six tutorials *(Semester 2).*

Description: On completion of 610-280, students should comprehend the relationship between chemistry and the environment: namely the sources, reactions, transport, effects and fates of chemical species in the water, soil and atmospheric environments; the consequences of changes in the chemical composition of the environment for humankind and other species; and the consequences of energy utilisation. Students should appreciate the need for the integration of a chemically centred study of the environment with other approaches to the treatment of environmental data, and have developed an appreciation of the role of environmental chemistry in a wider social context.

Students should have developed skills in recognising chemically based environmental problems, an awareness of the possible effects of chemicals on the environment and a capacity to interpret environmental data and to apply diverse chemical principles in the explanation of environmental phenomena. Students should appreciate the need for high quality environmental analysis, the links between the misuse of chemicals and pollution events, and the importance of selecting and utilising appropriate analytical methods and techniques for their monitoring. Students should understand the principles of the key analytical methods used in environmental chemistry.

Students will also develop skills in investigating contemporary environmental chemistry issues, a consideration of the wider context of these issues, generic skills in operating in small teams and an awareness of professional practice as a scientist.

The subject matter in 610-280 covers some or all of the following topics: emissions to the troposphere; behaviour of pollutants in the troposphere and stratosphere; ozone and SMOG chemistry; air pollution potential (chemistry and meteorology); airborne particulates; acid rain and the greenhouse effect; the ozone layer; the structure and chemistry of freshwater bodies; the chemistry of nutrients; dissolved oxygen, Henry's Law and oxygen demand; the environmental impact of selected examples of metals, organic priority pollutants, pesticides and herbicides; water quality and health; the chemistry of soils (formation, constituents and properties); sources and characteristics of soil contaminants; absorption and persistence of contaminants in soils; soil degradation, salinity and acid-sulphate soils; chemical assessment of contaminated soils; introduction to soil and water remediation, energy utilisation and conservation; and the most frequently used environmental monitoring instrumental analytical techniques. A key aspect will be the comprehensive investigation of a current environmental chemistry issue, which will be taught in a small-group, scenario-based learning mode.

Assessment: Written assignments not exceeding 15 pages due during the semester (20%); a 3-hour written examination in the examination period (80%).

300-level subjects

610-310 Physical Chemistry IIIA

Note: Credit cannot be gained for this subject and 610-311 or 610-315.

Credit points: 12.5

Coordinator: Prof F Grieser

Prerequisites: Chemistry 610-210 or 610-211 and 610-215 (1998: 610-215 plus 610-210 or 610-211).

Contact: Twenty-four lectures (three per week for eight weeks) and 32 hours of practical work *(Semester 1).*

Description: Upon completion of 610-310, students should relate UV-visible spectroscopy to the fates of electronically excited molecules; understand photochemical kinetics and its application to controlling light-induced processes; understand the main concepts of equilibrium electrochemistry and be able to apply electrochemical principles to interpret the behaviour of solutions and galvanic cells; understand the nature of a surface and the phenomena of spreading behaviour of liquids, capillary rise, vapour pressure, superheating, crystal solubility and super-saturation; understand the processes of micelle formation from surfactants and gas adsorption on solids; and have developed skills in experimental techniques and instrumental methods of physical chemistry.

The subject covers surface chemistry, electrochemistry, photochemistry, and reactions of reactive intermediates.

The practical course will consist of a number of experiments involving the physical and instrumental investigations of important chemical systems and phenomena.

Assessment: Ongoing assessment of practical work in the form of short reports due during the semester (25%); written assignments not exceeding 10 pages due during the semester (5%); a 3-hour written examination in the examination period (70%). Satisfactory completion of practical work is necessary to pass the subject.

610-311 Physical Chemistry IIIB

Note: Credit cannot be gained for this subject and 610-310.

Credit points: 12.5

Coordinator: Prof F Grieser

Prerequisites: Chemistry 610-210 or 610-211. Concurrent enrolment in 610-315 is strongly recommended.

Contact: 36 lectures *(Semester 1).*

Description: Upon completion of 610-311, students should understand the basis behind statistical mechanics and intermolecular forces and how these relate to the formation and stability of complex fluids/phases and soft condensed matter; understand the concepts of equilibrium electrochemistry and the principles controlling the rates of electrode processes; be able to quantitatively describe the role of surfaces in a variety of important chemical phenomena and to use models to describe micelle formation from surfactants; understand the range of techniques for the production of atomic and free radical species and the kinetic aspects of abstraction, addition and branched chain reactions; appreciate the principles of molecular spectroscopy, spectral interpretation and laser action; be able to quantitatively characterise excited state properties and understand their significance in processes such as photosynthe-

sis and photodegradation of materials; and understand the solution properties of macromolecules.

The subject covers surface chemistry; electrochemistry; photochemistry; reactions of unstable species; complex fluids and their phase behaviour; and macromolecules.

Assessment: Written assignments not exceeding 15 pages due during the semester (10%); a 3-hour written examination in the examination period (90%).

610-315 Physical Chemistry Practical III

Note: Credit cannot be gained for this subject and 610-310 (Before 1999: 610-311).

Credit points: 6.25

Coordinator: Prof F Grieser

Prerequisites: 610-210 or (610-211 and 610-215) (1998: 610-210 or 610-211 and 610-215). Concurrent enrolment in 610-311 is strongly recommended.

Contact: 48 hours of practical work *(Semester 1).*

Description: Upon completion of 610-315, students should have developed skills in conducting instrument-based laboratory experiments in kinetics, surface chemistry, electrochemistry, photochemistry, and polymer and surfactant chemistry. The range of practical exercises will also develop observational skills and scientific report-writing skills.

The course will consist of a number of experiments involving the physical and instrumental investigations of important chemical systems and phenomena.

Assessment: Ongoing assessment of practical work in the form of short reports and assignments due during the semester (100%)

610-320 Organic Chemistry IIIA

Note: Credit cannot be gained for this subject and 610-321 or 610-325.

Credit points: 12.5

Coordinator: A/Prof M A S Rizzacasa

Prerequisites: Chemistry 610-220 or 610-221 and 610-225 (1998: 610-225 plus 610-220 or 610-221).

Contact: 24 lectures (three per week for eight weeks), eight tutorials, 32 hours practical work *(Semester 2).*

Description: Upon completion of 610-320, students should comprehend the main types of chemical transformations involved in the synthesis of organic compounds; the range of agents available to effect these transformations; the different types of stereochemical complexity of organic compounds; factors which influence stereochemical outcome; and the procedures for determination of the structures of organic compounds by spectroscopic and chemical techniques.

Students should have also developed time and resource management skills; skills to synthesise a range of organic molecules; knowledge of the application and interpretation of a range of spectroscopic and physical techniques; and experience in reporting the results of an experimental study.

Students should also appreciate the importance of rational, critical and independent thought in chemical science and in the understanding of organic chemistry.

The subject covers pericyclic reactions; the chemistry of alkenes; organometallic reactions, enolates, aldol and related reactions, and the Wittig reaction; reductions and rearrangements with emphasis on chemo-, regio-, and stereoselectivity; and applications of nuclear magnetic resonance and mass spectrometry to the determination of structure.

The practical course will consist of a number of experiments involving the synthesis and/or chemical and/or instrumental investigations of important classes of organic compounds.

Assessment: Ongoing assessment of practical work in the form of short reports due during the semester (33%); written assignments not exceeding six pages due during the semester (10%); a 3-hour written examination in the examination period (57%). Satisfactory completion of both theory and practical work is necessary to pass the subject.

610-321 Organic Chemistry IIIB

Note: Credit cannot be gained for this subject and 610-320.

Credit points: 12.5

Coordinator: A/Prof M A S Rizzacasa

Prerequisites: Chemistry 610-220 or 610-221. Concurrent enrolment in 610-325 is strongly recommended.

Contact: 36 lectures and 12 tutorials *(Semester 2).*

Description: Upon completion of 610-321, students should comprehend the main types of chemical transformations involved in the synthesis of organic compounds; the range of agents available to effect these transformations; the different types of stereochemical complexity of organic compounds; factors which influence stereochemical outcome; the procedures for determination of the structures of organic compounds by spectroscopic and chemical techniques; the theoretical basis of organic chemical reactions; and the concept of reaction mechanisms and the methods used to delineate these mechanisms.

Students should also appreciate the importance of rational, critical and independent thought in chemical science and in the understanding of organic chemistry.

The subject covers pericyclic reactions; the chemistry of alkenes; organometallic reactions, enolates, aldol and related reactions, and the Wittig reaction; free-radical chemistry; reductions and rearrangements with emphasis on chemo-, regio-, and stereo-selectivity; applications of nuclear magnetic resonance and mass spectrometry to the determination of structure; concerted and stepwise processes; detection and identification of intermediates and products; and applications of infrared, nuclear magnetic resonance and mass spectrometry.

Assessment: Written assignments not exceeding six pages due during the semester (10%); a 3-hour written examination in the examination period (90%).

610-325 Organic Chemistry Practical III

Note: Credit cannot be gained for this subject and 610-320 (before 1999: 610-321).

Credit points: 6.25

Coordinator: A/Prof M A S Rizzacasa

Prerequisites: 610-220 or 610-221 and 610-225 (1998: 610-225, plus 610-220 or 610-221). Concurrent enrolment in 610-321 is strongly recommended.

Contact: 48 hours of practical work *(Semester 2).*

Description: Upon completion of 610-325, students should have developed time and resource management skills; skills to synthesise a range of organic molecules; knowledge of the application and interpretation of a range of spectroscopic and physical techniques; and experience in reporting the results of an experimental study.

The course will consist of a number of experiments involving the synthesis and/or chemical and/or instrumental investigations of important classes of organic compounds.

Assessment: Ongoing assessment of practical work in the form of short reports due during the semester (100%).

610-332 Bio-organic Chemistry

Credit points: 12.5

Coordinator: Dr S J Williams

Prerequisites: At least one of the following: chemistry 610-220, chemistry 610-221 or 25 points of 200-level biochemistry subjects.

Contact: 36 lectures (3 per week for 12 weeks) *(Semester 1).*

Description: Upon completion of 610-332, students should have developed an understanding of the structure and stereochemistry of steroidal systems, the principal modes of biosynthesis operating in living organisms, the organic chemistry that underpins the pathways of primary metabolism, the chemistry of two major biological polymers (proteins and carbohydrates), and modern methods of chemical biology. Students should also develop interdisciplinary skills and an understanding of the philosophical methodological bases of research activity.

Students should also appreciate the importance of rational, critical and independent thought in chemical and biological science and in the understanding of organic chemistry.

The subject will cover the following topics. Natural products (12 lectures): the conception, establishment and application of biosynthetic theories as they apply to steroids, polyketides, terpenoids and alkaloids; Metabolism (12 lectures): a mechanistic, chemical and stereochemical treatment of primary metabolism; Vitamins (for example, thiamine, pantothenic acid, lipoic acid) and their role as components of co-enzymes in metabolism; Biological polymers and chemical biology (12 lectures): peptide and protein chemistry; chemoselective ligations in chemical biology; carbohydrate structure and synthesis; and biological information storage.

Assessment: Written assignments not exceeding six pages due during the semester (10%); a 3-hour written examination in the examination period (90%).

Prescribed texts: J McMurry, *Organic Chemistry*, 5th edn, Brooks/Cole 1999.

610-333 Molecular Technology

Credit points: 12.5

Coordinator: A/Prof P Mulvaney

Prerequisites: At least two of chemistry 610-210 or 610-211; 610-220 or 610-221; 610-240 or 610-241; 610-260; 610-280.

Contact: 36 lectures (three per week) *(Semester 2).*

Description: Upon completion of 610-333, students should have an understanding of the development and application of molecular technology. Developments in the modern chemistry industry will be examined together with the rise of 'new' technologies in the biological, materials and nanotechnology sectors. Additionally, the course continues the development and training of students in scientific method, analysis and observation. It teaches students skills in interpretation, professional presentation and quantitative analysis.

The program will be selected from the following topics:

- petrochemicals: synthesis on the industrial scale; non-renewable and renewable carbon sources;
- pharmaceuticals and Agricultural Derivatives: natural and synthetic agents for animal and human health and crop protection;
- industrial processes involving photochemical, electrochemical, sonochemical and stereoselective key steps;
- polymers: fundamental properties; smart polymers; biodegradable systems, conducting polymers;
- advanced materials: introduction to materials chemistry, bonding, band structure, electronic and optical properties of materials; atomic force microscopy, scanning tunnelling microscopy; quantum size effects; advanced materials such as conducting glass, solar cells, LEDs.

Assessment: Written assignments not exceeding 10 pages due during the semester (10%); three 30-minute written class tests held during the semester (10%); a 3-hour written examination in the examination period (80%).

610-340 Inorganic Chemistry IIIA

Note: Credit cannot be gained for both this subject and 610-341 or 610-345.

Credit points: 12.5

Coordinator: Dr S P Best

Prerequisites: Chemistry 610-240 or 610-241 and 610-245.

Contact: 24 lectures (three per week for eight weeks), eight tutorials and 32 hours of practical work *(Semester 1).*

Description: Upon completion of this subject, students should comprehend the main types of reactions of coordination compounds, cluster molecules, organometallic species and biomolecules; understand the reasons for the different types of structures observed for such molecules; have developed a knowledge of the procedures for determination of the structures via spectroscopic and related techniques, and be able to identify the mechanisms of the more important reactions and evaluate the effect that this has on the chemistry. In addition, students should have an appreciation of the electronic structure and photochemistry of metal complexes; the structure of the solid state; and apply concepts developed in relation to small molecule chemistry to catalysis in biological and non-biological systems.

The practical course will consist of a number of experiments involving the synthesis and/or chemical and/or instrumental investigations of important classes of main group and transition metal coordination and organometallic compounds.

This subject will provide the student with the opportunity to establish/develop the following generic skills: an advanced understanding of the changing knowledge base, problem-solving and critical thinking skills, an ability to evaluate the research and professional literature, a capacity to apply concepts developed in one area to a different context, and the ability to use conceptual models to rationalise observations, a capacity to articulate knowledge and understanding in written presentations, a capacity to manage competing demands on time, including self-directed work.

Assessment: Ongoing assessment of practical work in the form of short reports due during the semester (25%); written assignments not exceeding six pages due during the semester (10%); a 3-hour written examination in the examination period on theory and practical components (65%). This examination will comprise a 2-hour section on theory (57% of total subject assessment) and a 1-hour multiple choice section on the practical work (8% of total subject assessment). Satisfactory completion of both theory and practical work is necessary to pass the subject.

610-341 Inorganic Chemistry IIIB

Note: Credit cannot be gained for this subject and 610-340.

Credit points: 12.5

Coordinator: Dr S P Best

Prerequisites: Chemistry 610-240 or 610-241. Concurrent enrolment in 610-345 is strongly recommended.

Contact: 36 lectures and 12 tutorials *(Semester 1).*

Description: Upon completion of this subject, students should comprehend the main types of reactions of coordination compounds, cluster molecules, organometallic species and biomolecules; understand the reasons for the different types of structures observed for such molecules; have developed a knowledge of the procedures for determination of the structures via spectroscopic and related techniques; be able to identify the mechanisms of the more important reactions and evaluate the effect that this has on the chemistry; have an appreciation of the electronic structure and photochemistry of metal complexes; understand the structure of the solid state; and apply concepts developed in relation to small molecule chemistry to catalysis in biological and non-biological systems.

The lecture course covers symmetry, group theory, and their applications; metal and main group chemistry; coordination, cluster and organometallic species; reactivity, including redox and catalytic processes; and applications of nuclear magnetic resonance and related structural techniques.

This subject will provide the student with the opportunity to establish and develop the following generic skills: an advanced understanding of the changing knowledge base, problem-solving and critical thinking skills, an ability to evaluate the research and professional literature, a capacity to apply concepts developed in one area to a different context, and the ability to use conceptual models to rationalise observations.

Assessment: Written assignments not exceeding six pages due during the semester (10%); a 3-hour written examination in the examination period (90%).

610-345 Inorganic Chemistry Practical III

Note: Credit cannot be gained for this subject and 610-340 (Before 1999: 610-341).

Credit points: 6.25

Coordinator: Dr S P Best

Prerequisites: 610-240, or 610-241 plus 610-245 (1998: 610-245 plus 610-240 or 610-241). Concurrent enrolment in 610-341 is strongly recommended.

Contact: 48 hours practical work *(Semester 1).*

Description: Upon completion of 610-345, students should have developed time and resource management skills; skills to synthesise a range of inorganic molecules; knowledge of the application and interpretation of a range of spectroscopic and physical techniques; experience in reporting the results of an experimental study; and a capacity to manage competing demands on time, including self-directed work.

The program will consist of a number of experiments involving the synthesis and/or chemical and/or instrumental investigations of important classes of main group and transition metal coordination and organometallic compounds.

Assessment: Ongoing assessment of practical work in the form of short reports due during the semester (83%); a 20-minute oral examination held in the week following the completion of practical work (17%).

610-360 Analytical & Environmental Chemistry

Note: Credit cannot be gained for this subject and before 1998: 610-346.

Credit points: 12.5

Coordinator: Dr S D Kolev

Prerequisites: Either Chemistry 610-260 or 610-280.

Contact: 18 lectures and 32 hours of practical (project) work *(Semester 2).*

Description: This subject covers the main sources and types of environmental contaminants in the biosphere (water, soil and air) with a focus on water contaminants and their effect on water quality. The most frequently used analytical techniques in environmental and industrial monitoring and analysis will be outlined in the context of achieving desirable environmental outcomes. These techniques include volumetric analysis, gravimetric analysis, optical techniques such as inductively coupled plasma optical emission spectrometry, and electroanalytical techniques such as potentiometry (ion-selective electrodes, potentiometric stripping analysis) and voltammetry (polarography, anodic stripping voltammetry). Upon completion of the subject, students will have acquired an in-depth understanding of the origin, distribution and role of environmental contaminants, and be able to select suitable methods for monitoring them. Students will also learn to apply analytical and problem-solving skills to the consideration of treatment options for industrial effluents. From the practical component, students will acquire enhanced laboratory skills and competence in using modern laboratory techniques.

Assessment: Ongoing assessment of practical work in the form of short laboratory reports due during the semester (50%); a 45-minute written test held mid-semester (10%); a 2-hour written examination in the examination period (40%). Satisfactory completion of both theory and practical work is necessary to pass the subject.

610-399 Chemical Research Project

Note: Enrolment in this subject is strongly recommended for all students enrolled in 75 or more points of 300-level chemistry.

Credit points: 12.5

Coordinator: Head, School of Chemistry

Prerequisites: Students must be enrolled in at least 50 points of 300-level chemistry subjects, and have completed (or be concurrently enrolled in) at least one of the four 300-level core subjects (as defined in the chemistry major) prior to commencement of this subject.

BBiomedSc sudents are required to enrol in at least 37.5 points of 300-level chemistry and have completed (or be concurrently enrolled in) at least one of the four 300-level core subjects (as defined in the chemistry major) prior to commencement of this subject.

Contact: One lecture and 96 hours of laboratory work *(Semester 2, repeat Summer).*

Description: The subject is designed to introduce students to independent original research; to further develop practical skills; to train the student to use the chemical literature; to train the student in the art of assessing the results obtained; and to develop written and oral communication skills.

At the completion of the subject, the student should comprehend the importance of a critical review of work already published in the field; the necessity for careful planning of the research work; and the importance of accurate observation and recording of data.

Students will carry out a short chemical investigation under the direction of a School of Chemistry staff member. Each student will be required to prepare and deliver both a written and an oral report on the investigation.

Assessment: A written report of no more than 1500 words due at the end of the semester (60%); supervisor assessment of demonstrated research potential (30%); oral presentation of no more than 15 minutes duration at the end of semester (10%). Satisfactory performance in each of these assessment components is necessary to pass the subject.

600-311 Research Project A

See full subject details on page 1.

600-312 Research Project B

See full subject details on page 1.