# Civil and Environmental Engineering

## Civil Engineering

Civil engineering has been taught at the University of Melbourne since 1860. From an initial certificate course, the demands of the profession have seen the development of not only a single degree in civil engineering in 1893, but also combined degrees: civil engineering with commerce, science, arts or law.

Civil engineering is a diverse and broad-ranging discipline concerned with designing and constructing the national infrastructure. Civil engineers are concerned with sustainable development and environmental management, and in most activities they work as part of an interdisciplinary team, often as the team leader, utilising their project management skills. Civil engineers may work as 'general practitioners' or they may specialise in the sub-disciplines of structural, geotechnical, water resources, coastal, transport engineering or construction.

The BE degree in civil engineering comprises a core of compulsory subjects complemented by electives in each year of the course. First and second years concentrate on developing an understanding of engineering sciences aspects of engineering. This is done through subjects that include mathematics, computing, solid, fluid and geo mechanics, and material behaviour. These subjects are supported with introductory courses in design and engineering management.

In third and fourth years the primary focus is on the application of engineering theory in the areas of hydraulics, water resources, geotechnical engineering, structures and transport. Studies in management and construction engineering are also mandatory.

## Environmental Engineering

The Environmental Engineering degree course is underpinned by a 40-year tradition of teaching and research in land and water management and environmental issues.

The objective of the course in environmental engineering is to graduate professional engineers with leadership qualities in engineering aspects of land and water management and environmental assessment, and skills in surface and groundwater hydrology, hydrogeology, irrigation engineering and water supply, land reclamation and sediment, nutrient and solute transport. Such engineers should be able to converse scientifically with biologists, ecologists and resource managers, have analytical, synthesis and numerical skills, and have experience in computing, field and laboratory techniques relating to natural resources. With these skills, graduates will be able to play a leading role in developing engineering solutions to a wide range of problems and opportunities within an ecologically sustainable context.

The first year of the environmental engineering stream is flexible, but contains a solid grounding in mathematics, chemistry and basic engineering science. Engineering projects are introduced as a vehicle to discover the diverse nature of engineering inputs and the relationship of engineering to the natural environment and a sustainable world. A feature of first year is a field trip to assist the cohort of students to develop social links as well as discover a range of environmental engineering issues. Second year develops themes from first year to introduce basic engineering science and design. Links between environmental engineering and the natural sciences are developed in the areas of biology, earth sciences and chemistry. Management principles applicable to the natural environment are also introduced. In third year the course has an emphasis on hydraulics, hydrology and design. A practical course, including a one-week field trip covering techniques for gathering the data required for design, appears at this level. Analysis of spatial systems is introduced, while management and political aspects and interactions are further developed.

At fourth-year level, in addition to design and a major research project, four themes are developed in management and communication, hydrology, water management and land management. Advanced learning in analysis and modeling of the physical processes provides students with an exclusive skill set to take to the workforce or postgraduate education.

## Attributes of our graduates

The undergraduate degree streams are accredited by Engineers Australia. In order to achieve this accreditation we aim to develop the following attributes in our graduates:

- ability to apply knowledge of basic science and engineering fundamentals;
- ability to communicate effectively, not only with engineers but also with the community at large;
- in-depth technical competence in at least one engineering discipline;
- ability to undertake problem identification, formulation and solution;
- ability to utilise a systems approach to design and operational performance;
- ability to function effectively as an individual and in multi-disciplinary and multicultural teams, with the capacity to be a leader or manager as well as an effective team member;
- understanding of the social, cultural, global and environmental responsibilities of the professional engineer, and the need for sustainable development;
- understanding of the principles of sustainable design and development;
- understanding of and commitment to professional and ethical responsibilities; and
- expectation and capacity to undertake life-long learning.

## Undergraduate degree course structures

### Bachelor of Engineering (Civil) (BE)

The course structure below represents the core content for the BE (Civil) degree. All students should check that they have taken the listed subjects, or equivalent. For further information and up-to-date course advice students should regularly check the Department of Civil and Environmental Engineering's course advice page on the world wide web at <http://www.civag.unimelb.edu.au/undergraduate>.

When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that departmental guidelines on electives are satisfied (see <http://www.civag.unimelb.edu.au/undergraduate>). Students should also avoid timetable clashes in choosing their electives. In particular, students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

| **First year** | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-106 | Engineering Communication & Computing *(p.8)* | 12.5 |
| 421-103 | Engineering Statics *(p.8)* | 12.5 |
| 421-121 | Materials 1 *(p.9)* | 12.5 |
| 620-121 | Mathematics A (Advanced) *(p.4)* | 12.5 |
| or | | |
| 620-141 | Mathematics A *(p.5)* | 12.5 |
| **Semester 2** | | |
| 421-101 | Civil Engineering Introduction *(p.8)* | 12.5 |
| 421-112 | Dynamics and Measurement Systems *(p.8)* | 12.5 |
| 421-122 | Materials 2 *(p.9)* | 12.5 |
| 620-123 | Applied Mathematics (Advanced) *(p.4)* | 12.5 |
| or | | |
| 620-143 | Applied Mathematics *(p.5)* | 12.5 |

| **Second year** | | Points |
|---|---|---|
| **Semester 1** | | |
| 431-201 | Engineering Analysis A *(p.11)* | 12.5 |
| 421-208 | Mechanics of Solids *(p.9)* | 12.5 |
| 421-255 | Management for Engineers 1 *(p.9)* | 12.5 |
| 451-201 | Geomatics for Engineers *(p.6)*[1] | 12.5 |
| **Semester 2** | | |
| 431-202 | Engineering Analysis B *(p.12)* | 12.5 |
| 421-207 | Introduction to Design *(p.9)* | 12.5 |
| 421-209 | Geomechanics 1 *(p.9)* | 12.5 |
| Elective | | 12.5 |

1. Or elective approved by the Department of Civil and Environmental Engineering.

| **Third year** | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-305 | Engineering Hydraulics 1 *(p.10)* | 12.5 |
| 421-306 | Geotechnical Engineering *(p.10)* | 12.5 |
| 421-307 | Structural Engineering 1 *(p.10)* | 12.5 |
| 421-355 | Management for Engineers 2 *(p.11)* | 12.5 |
| **Semester 2** | | |
| 421-316 | Engineering Hydraulics & Hydrology *(p.10)* | 12.5 |
| 421-317 | Structural Engineering 2 *(p.10)* | 12.5 |
| 421-318 | Construction Engineering *(p.10)* | 12.5 |
| 625-023 | Geology (Engineering Course) *(p.5)*[1] | 12.5 |

1. Or elective approved by the Department of Civil and Environmental Engineering.

| Fourth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-401 | Techniques of Research and Investigation *(p.11)* | 6.25 |
| 421-405 | Management for Engineers 3 *(p.12)* | 12.5 |
| 421-410 | Structural Steel Theory & Design *(p.12)* | 6.25 |
| 421-447 | Transport Engineering *(p.12)* | 12.5 |
| Civil engineering elective[1] | | 12.5 |
| **Semester 2** | | |
| 421-411 | Concrete Theory & Design *(p.12)* | 6.25 |
| 421-420 | Hydraulic Engineering Design *(p.12)* | 6.25 |
| Civil engineering electives[2] | | 37.5 |

1. Or elective approved by the Department of Civil and Environmental Engineering
2. Or electives approved by the Department of Civil and Environmental Engineering

## Bachelor of Engineering (Engineering Management) (Civil)

The course structure below represents the core content for the Civil Engineering specialisation within the BE (Engineering Management) degree. The course structure for later years of this course will be published as they become available for study. All students should check that they have taken the listed subjects, or equivalent. For further information and up-to-date course advice students should regularly check the Department of Civil and Environmental Engineering's course advice page at <http://www.civag.unimelb.edu.au/undergraduate>.

When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that departmental guidelines on electives are satisfied (see <http://www.civag.unimelb.edu.au/undergraduate>). Students should also avoid timetable clashes in choosing their electives. In particular, students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

| First year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-121 | Materials 1 *(p.9)* | 12.5 |
| 421-106 | Engineering Communication & Computing *(p.8)* | 12.5 |
| 620-141 | Mathematics A *(p.5)* | 12.5 |
| or | | |
| 620-121 | Mathematics A (Advanced) *(p.4)* | 12.5 |
| 421-103 | Engineering Statics *(p.8)* | 12.5 |
| **Semester 2** | | |
| 325-101 | Managing People and Organisations *(p.1)* | 12.5 |
| 421-112 | Dynamics and Measurement Systems *(p.8)* | 12.5 |
| 620-143 | Applied Mathematics *(p.5)* | 12.5 |
| or | | |
| 620-123 | Applied Mathematics (Advanced) *(p.4)* | 12.5 |
| Commerce subject | | 12.5 |

| Second year | | Points |
|---|---|---|
| **Semester 1** | | |
| 431-201 | Engineering Analysis A *(p.11)* | 12.5 |
| 421-208 | Mechanics of Solids *(p.9)* | 12.5 |
| 421-258 | Engineering Business Management *(p.10)* | 12.5 |
| Commerce subject* | | 12.5 |
| **Semester 2** | | |
| 421-207 | Introduction to Design *(p.9)* | 12.5 |
| 421-209 | Geomechanics 1 *(p.9)* | 12.5 |
| 431-202 | Engineering Analysis B *(p.12)* | 12.5 |
| 421-122 | Materials 2 *(p.9)* | 12.5 |

* Commerce subject must be either a level-200 or level-300 and the pre-requisites met where necesssary

| Third year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-305 | Engineering Hydraulics 1 *(p.10)* | 12.5 |
| 421-306 | Geotechnical Engineering *(p.10)* | 12.5 |
| 421-307 | Structural Engineering 1 *(p.10)* | 12.5 |
| 421-358 | Technoeconomic Decision Making *(p.11)* | 12.5 |
| **Semester 2** | | |
| 421-316 | Engineering Hydraulics & Hydrology *(p.10)* | 12.5 |
| 421-317 | Structural Engineering 2 *(p.10)* | 12.5 |
| 421-318 | Construction Engineering *(p.10)* | 12.5 |
| Commerce subject* | | 12.5 |

* Commerce subject must be either a level-200 or level-300 and the pre-requisites met where necesssary

## Bachelor of Engineering - jointly badged program in Civil Engineering

A new international joint degree between the National University of Singapore and University of Melbourne is available for students commencing studies in 2006 in the field of Civil Engineering. The degree enables students to study at the University of Melbourne for Semesters 1, 2, 3, 7 and 8 and the National University of Singapore for semesters 4, 5 and 6. This unique joint degree program will provide a rich learning experience for students wishing to maximise their opportunities in the global graduate employment market and to develop a combination of specialist skills from the two institutions. Further details are available from <http://www.civag.unimelb.edu.au/undergraduate/>.

## Bachelor of Arts/Bachelor of Engineering (Civil) (BA/BE)

Students studying the BE/BA degree should consult the BE single degree course structure for a current list of core engineering subjects. For further information and up-to-date course advice students should regularly check the Department of Civil and Environmental Engineering's course advice page at <http://www.civag.unimelb.edu.au/undergraduate>/.

When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that departmental guidelines on electives are satisfied (see: <http://www.civag.unimelb.edu.au/undergraduate/>). Students should also avoid timetable clashes in choosing their electives. In particular, students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

| First year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-106 | Engineering Communication & Computing *(p.8)* | 12.5 |
| 620-121 | Mathematics A (Advanced) *(p.4)* | 12.5 |
| or | | |
| 620-141 | Mathematics A *(p.5)* | 12.5 |
| Arts subjects as required | | 25 |
| **Semester 2** | | |
| 421-101 | Civil Engineering Introduction *(p.8)* | 12.5 |
| 620-123 | Applied Mathematics (Advanced) *(p.4)* | 12.5 |
| or | | |
| 620-143 | Applied Mathematics *(p.5)* | 12.5 |
| Arts subjects as required | | 25 |

| Second year | | Points |
|---|---|---|
| **Semester 1** | | |
| 431-201 | Engineering Analysis A *(p.11)* | 12.5 |
| 421-103 | Engineering Statics *(p.8)* | 12.5 |
| Arts subjects as required | | 25 |
| **Semester 2** | | |
| 431-202 | Engineering Analysis B *(p.12)* | 12.5 |
| 421-112 | Dynamics and Measurement Systems *(p.8)* | 12.5 |
| 421-122 | Materials 2 *(p.9)* | 12.5 |
| Arts subjects as required | | 12.5 |

| Third year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-208 | Mechanics of Solids *(p.9)* | 12.5 |
| 421-255 | Management for Engineers 1 *(p.9)* | 12.5 |
| Arts subjects as required | | 25 |
| **Semester 2** | | |
| 421-207 | Introduction to Design *(p.9)* | 12.5 |
| 421-209 | Geomechanics 1 *(p.9)* | 12.5 |
| Arts subjects as required | | 25 |

| Fourth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-305 | Engineering Hydraulics 1 *(p.10)* | 12.5 |
| 421-306 | Geotechnical Engineering *(p.10)* | 12.5 |

| Fourth year | | Points |
|---|---|---|
| 421-307 | Structural Engineering 1 *(p.10)* | 12.5 |
| 421-355 | Management for Engineers 2 *(p.11)* | 12.5 |
| **Semester 2** | | |
| 421-316 | Engineering Hydraulics & Hydrology *(p.10)* | 12.5 |
| 421-317 | Structural Engineering 2 *(p.10)* | 12.5 |
| 421-318 | Construction Engineering *(p.10)* | 12.5 |
| Arts subject as required | | 12.5 |

| Fifth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-401 | Techniques of Research and Investigation *(p.11)* | 6.25 |
| 421-405 | Management for Engineers 3 *(p.12)* | 12.5 |
| 421-410 | Structural Steel Theory & Design *(p.12)* | 6.25 |
| 421-447 | Transport Engineering *(p.12)* | 12.5 |
| Arts subject as required | | 12.5 |
| **Semester 2** | | |
| 421-411 | Concrete Theory & Design *(p.12)* | 6.25 |
| 421-420 | Hydraulic Engineering Design *(p.12)* | 6.25 |
| Arts subjects as required | | 37.5 |

## Bachelor of Engineering (Civil)/Bachelor of Commerce (BE/BCom)

Students studying the BE/BCom degree should consult the BE single degree course structure for a current list of core engineering subjects. For further information and up-to-date course advice students should regularly check the Department of Civil and Environmental Engineering's course advice page at <http://www.civag.unimelb.edu.au/undergraduate>.

When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that departmental guidelines on electives are satisfied (see <http://www.civag.unimelb.edu.au/undergraduate/>). Students should also avoid timetable clashes in choosing their electives. In particular, students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

| First year | | Points |
|---|---|---|
| **Semester 1** | | |
| 316-102 | Introductory Microeconomics *(p.1)* | 12.5 |
| 421-106 | Engineering Communication & Computing *(p.8)* | 12.5 |
| 620-121 | Mathematics A (Advanced) *(p.4)* | 12.5 |
| or | | |
| 620-141 | Mathematics A *(p.5)* | 12.5 |
| Commerce subject as required | | 12.5 |
| **Semester 2** | | |
| 316-101 | Introductory Macroeconomics *(p.1)* | 12.5 |
| 316-130 | Quantitative Methods 1 *(p.1)* | 12.5 |
| 421-101 | Civil Engineering Introduction *(p.8)* | 12.5 |
| 620-123 | Applied Mathematics (Advanced) *(p.4)* | 12.5 |
| or | | |
| 620-143 | Applied Mathematics *(p.5)* | 12.5 |

| Second year | | Points |
|---|---|---|
| **Semester 1** | | |
| 316-205 | Introductory Econometrics *(p.1)* | 12.5 |
| 421-103 | Engineering Statics *(p.8)* | 12.5 |
| 431-201 | Engineering Analysis A *(p.11)* | 12.5 |
| Commerce subject as required | | 12.5 |
| **Semester 2** | | |
| 421-112 | Dynamics and Measurement Systems *(p.8)* | 12.5 |
| 421-122 | Materials 2 *(p.9)* | 12.5 |
| 431-202 | Engineering Analysis B *(p.12)* | 12.5 |
| 325-201 | Organisational Behaviour *(p.1)* | 12.5 |

| Third year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-208 | Mechanics of Solids *(p.9)* | 12.5 |
| 421-255 | Management for Engineers 1 *(p.9)* | 12.5 |
| Commerce subjects as required | | 25 |
| **Semester 2** | | |
| 421-207 | Introduction to Design *(p.9)* | 12.5 |

| Third year | | Points |
|---|---|---|
| 421-209 | Geomechanics 1 *(p.9)* | 12.5 |
| Commerce subjects as required | | 25 |

| Fourth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-305 | Engineering Hydraulics 1 *(p.10)* | 12.5 |
| 421-306 | Geotechnical Engineering *(p.10)* | 12.5 |
| 421-307 | Structural Engineering 1 *(p.10)* | 12.5 |
| 421-356 | Management for Engineers 2C *(p.11)* | 12.5 |
| **Semester 2** | | |
| 421-316 | Engineering Hydraulics & Hydrology *(p.10)* | 12.5 |
| 421-317 | Structural Engineering 2 *(p.10)* | 12.5 |
| 421-318 | Construction Engineering *(p.10)* | 12.5 |
| Commerce subject as required | | 12.5 |

| Fifth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-401 | Techniques of Research and Investigation *(p.11)* | 6.25 |
| 421-405 | Management for Engineers 3 *(p.12)* | 12.5 |
| 421-410 | Structural Steel Theory & Design *(p.12)* | 6.25 |
| 421-447 | Transport Engineering *(p.12)* | 12.5 |
| Commerce subject as required | | 12.5 |
| **Semester 2** | | |
| 421-411 | Concrete Theory & Design *(p.12)* | 6.25 |
| 421-420 | Hydraulic Engineering Design *(p.12)* | 6.25 |
| Commerce subjects as required | | 37.5 |

## Bachelor of Laws/Bachelor of Engineering (Civil) (LLB/BE)

Students studying the BE/LLB degree should consult the BE single degree course structure for a current list of core engineering subjects. For further information and up-to-date course advice students should regularly check the Department of Civil and Environmental Engineering's course advice page at <http://www.civag.unimelb.edu.au/undergraduate>.

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| First year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-106 | Engineering Communication & Computing *(p.8)* | 12.5 |
| 620-121 | Mathematics A (Advanced) *(p.4)* | 12.5 |
| or | | |
| 620-141 | Mathematics A *(p.5)* | 12.5 |
| 730-111 | Legal Method and Reasoning *(p.1)* | 12.5 |
| 730-112 | Principles of Public Law *(p.1)* | 12.5 |
| **Semester 2** | | |
| 421-101 | Civil Engineering Introduction *(p.8)* | 12.5 |
| 620-123 | Applied Mathematics (Advanced) *(p.4)* | 12.5 |
| or | | |
| 620-143 | Applied Mathematics *(p.5)* | 12.5 |
| 730-113 | Dispute Resolution *(p.1)* | 12.5 |
| 730-114 | Torts *(p.1)* | 12.5 |

| Second year | | Points |
|---|---|---|
| **Semester 1** | | |
| 431-201 | Engineering Analysis A *(p.11)* | 12.5 |
| 421-103 | Engineering Statics *(p.8)* | 12.5 |
| 730-212 | Legal Theory *(p.2)* | 12.5 |
| 730-213 | Obligations *(p.2)* | 12.5 |
| **Semester 2** | | |
| 421-122 | Materials 2 *(p.9)* | 12.5 |
| 431-202 | Engineering Analysis B *(p.12)* | 12.5 |
| 730-214 | Constitutional Law *(p.2)* | 12.5 |
| 730-215 | Contracts *(p.2)* | 12.5 |

| Third year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-208 | Mechanics of Solids *(p.9)* | 12.5 |
| 421-255 | Management for Engineers 1 *(p.9)* | 12.5 |
| 730-365 | Administrative Law *(p.3)* | 12.5 |
| 730-366 | Property *(p.3)* | 12.5 |
| **Semester 2** | | |
| 421-207 | Introduction to Design *(p.9)* | 12.5 |
| 421-209 | Geomechanics 1 *(p.9)* | 12.5 |
| 730-367 | Trusts *(p.3)* | 12.5 |
| 730-368 | Criminal Law and Procedure *(p.4)* | 12.5 |

| Fourth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-305 | Engineering Hydraulics 1 *(p.10)* | 12.5 |
| 421-306 | Geotechnical Engineering *(p.10)* | 12.5 |
| 421-307 | Structural Engineering 1 *(p.10)* | 12.5 |
| 421-355 | Management for Engineers 2 *(p.11)* | 12.5 |
| **Semester 2** | | |
| 421-316 | Engineering Hydraulics & Hydrology *(p.10)* | 12.5 |
| 421-317 | Structural Engineering 2 *(p.10)* | 12.5 |
| 421-318 | Construction Engineering *(p.10)* | 12.5 |
| Law subject as required | | 12.5 |

| Fifth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-401 | Techniques of Research and Investigation *(p.11)* | 6.25 |
| 421-405 | Management for Engineers 3 *(p.12)* | 12.5 |
| 421-410 | Structural Steel Theory & Design *(p.12)* | 6.25 |
| 421-447 | Transport Engineering *(p.12)* | 12.5 |
| Law subject as required | | 12.5 |
| **Semester 2** | | |
| 421-411 | Concrete Theory & Design *(p.12)* | 6.25 |
| 421-420 | Hydraulic Engineering Design *(p.12)* | 6.25 |
| Civil engineering elective(s) | | 12.5 |
| 730-453 | Remedies *(p.4)* | 12.5 |
| 730-454 | Legal Ethics *(p.4)* | 12.5 |

| Sixth year | | Points |
|---|---|---|
| Law subjects to meet requirements of LLB (total of 300 points) | | 100 |

## Bachelor of Engineering (Civil)/Bachelor of Science (BE/BSc)

Students studying the BE/BSc degree should consult the BE single degree course structure for a current list of core engineering subjects. For further information and up-to-date course advice students should regularly check the Department of Civil and Environmental Engineering's course advice page at <http://www.civag.unimelb.edu.au/undergraduate>.

When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that departmental guidelines on electives are satisfied (see <http://www.civag.unimelb.edu.au/undergraduate/>). Students should also avoid timetable clashes in choosing their electives. In particular, students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

| First year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-106 | Engineering Communication & Computing *(p.8)* | 12.5 |
| 620-121 | Mathematics A (Advanced) *(p.4)* | 12.5 |
| or | | |
| 620-141 | Mathematics A *(p.5)* | 12.5 |
| Science subjects as required | | 25 |
| **Semester 2** | | |
| 421-101 | Civil Engineering Introduction *(p.8)* | 12.5 |
| 620-123 | Applied Mathematics (Advanced) *(p.4)* | 12.5 |
| or | | |
| 620-143 | Applied Mathematics *(p.5)* | 12.5 |
| Science subjects as required[1] | | 25 |

1. Students intending to take 200-level Faculty of Science mathematics subjects are strongly recommended to take 620-160 Experimental Design and Data Analysis as part of the BSc.

| Second year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-103 | Engineering Statics *(p.8)* | 12.5 |
| 431-201 | Engineering Analysis A *(p.11)* | 12.5 |
| or | | |
| 620-231 | Vector Analysis *(p.7)* | 12.5 |
| Science subjects as required [1] | | 25 |
| **Semester 2** | | |
| 431-202 | Engineering Analysis B *(p.12)* | 12.5 |
| or | | |
| 620-232 | Mathematical Methods *(p.7)* | 12.5 |
| 421-112 | Dynamics and Measurement Systems *(p.8)* | 12.5 |
| 421-122 | Materials 2 *(p.9)* | 12.5 |
| Science subjects as required | | 12.5 |

1. Students intending to take 200-level Faculty of Science mathematics subjects should include in their science subject selection 620-122 Mathematics B (Advanced) or 620-142 Mathematics B in order to meet prerequisite requirements.

| Third year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-208 | Mechanics of Solids *(p.9)* | 12.5 |
| 421-255 | Management for Engineers 1 *(p.9)* | 12.5 |
| Science subject as required | | 25 |
| **Semester 2** | | |
| 421-207 | Introduction to Design *(p.9)* | 12.5 |
| 421-209 | Geomechanics 1 *(p.9)* | 12.5 |
| Science subjects as required | | 25 |

| Fourth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-305 | Engineering Hydraulics 1 *(p.10)* | 12.5 |
| 421-306 | Geotechnical Engineering *(p.10)* | 12.5 |
| 421-307 | Structural Engineering 1 *(p.10)* | 12.5 |
| 421-355 | Management for Engineers 2 *(p.11)* | 12.5 |
| **Semester 2** | | |
| 421-316 | Engineering Hydraulics & Hydrology *(p.10)* | 12.5 |
| 421-317 | Structural Engineering 2 *(p.10)* | 12.5 |
| 421-318 | Construction Engineering *(p.10)* | 12.5 |
| Science subject as required | | 12.5 |

| Fifth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-401 | Techniques of Research and Investigation *(p.11)* | 6.25 |
| 421-405 | Management for Engineers 3 *(p.12)* | 12.5 |
| 421-410 | Structural Steel Theory & Design *(p.12)* | 6.25 |
| 421-447 | Transport Engineering *(p.12)* | 12.5 |
| Science subject as required | | 12.5 |
| **Semester 2** | | |
| 421-411 | Concrete Theory & Design *(p.12)* | 6.25 |
| 421-420 | Hydraulic Engineering Design *(p.12)* | 6.25 |
| Science subjects as required | | 37.5 |

## Bachelor of Engineering (Environmental) (BE)

The course structure below represents the core content for the BE degree. All students should check that they have taken the listed subjects, or equivalent. Some common exceptions are listed below.

- 620-141 Mathematics A and 620-143 Applied Mathematics can be replaced by 620-121 Mathematics A (Advanced) and 620-123 Applied Mathematics (Advanced) with permission from the Department of Mathematics and Statistics.
- Year levels 1-4 show the approximate order in which combined course students should do subjects to avoid violating prerequisite requirements.

Students should regularly check the Department of Civil and Environmental Engineering's course advice page for additional information and up-to-date course advice at <http://www.civenv.unimelb.edu.au/undergraduate>.

When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that departmental guidelines on electives are satisfied (see <http://www.civenv.unimelb.edu.au/undergraduate>). Moreover, electives should be chosen so as to develop a specialisation, while ensuring a logical progression of year level and prerequisites. Students should also avoid timetable clashes in choosing their electives. In particular, students in combined degrees should

plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

| First year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-103 | Engineering Statics *(p.8)* | 12.5 |
| 421-106 | Engineering Communication & Computing *(p.8)* | 12.5 |
| 610-141 | Chemistry A *(p.2)* | 12.5 |
| 620-141 | Mathematics A *(p.5)* | 12.5 |
| or | | |
| 620-121 | Mathematics A (Advanced) *(p.4)* | 12.5 |
| **Semester 2** | | |
| 411-102 | Chemical Process Analysis *(p.5)* | 12.5 |
| 421-107 | Environmental Engineering Introduction *(p.8)* | 12.5 |
| 610-142 | Chemistry B *(p.2)* | 12.5 |
| 620-143 | Applied Mathematics *(p.5)* | 12.5 |
| or | | |
| 620-123 | Applied Mathematics (Advanced) *(p.4)* | 12.5 |
| **Second year** | | Points |
| **Semester 1** | | |
| 121-018 | Geomorphology *(p.3)* | 12.5 |
| 431-201 | Engineering Analysis A *(p.11)* | 12.5 |
| 421-210 | Environmental Engineering - Basics *(p.9)* | 12.5 |
| 421-255 | Management for Engineers 1 *(p.9)* | 12.5 |
| **Semester 2** | | |
| 421-209 | Geomechanics 1 *(p.9)* | 12.5 |
| 431-202 | Engineering Analysis B *(p.12)* | 12.5 |
| 610-280 | Environmental Chemistry *(p.5)* | 12.5 |
| Elective[2] | | 12.5 |
| **Third year** | | Points |
| **Semester 1** | | |
| 121-021 | Environmental Politics and Management *(p.3)* | 12.5 |
| 421-305 | Engineering Hydraulics 1 *(p.10)* | 12.5 |
| 421-325 | Field Data Acquisition and Analysis *(p.11)* | 12.5 |
| 421-355 | Management for Engineers 2 *(p.11)* | 12.5 |
| **Semester 2** | | |
| 421-316 | Engineering Hydraulics & Hydrology *(p.10)* | 12.5 |
| 421-322 | Environmental Engineering Design 1 *(p.11)* | 12.5 |
| 421-327 | Computing for Land and Spatial Systems *(p.11)* | 12.5 |
| Elective[2] | | 12.5 |
| **Fourth year** | | Points |
| **Semester 1** | | |
| 421-453 | Engineering Systems Management *(p.12)* | 6.25 |
| 421-456 | Engineering Management 3E *(p.13)* | 6.25 |
| 421-490 | Quantification of Physical Processes A *(p.13)* | 12.5 |
| 421-491 | Quantification of Physical Processes B *(p.13)* | 12.5 |
| Elective[2] | | 12.5 |
| **Semester 2** | | |
| 421-476 | Environmental Engineering Design 2 *(p.13)* | 12.5 |
| 421-477 | Research Project (Environmental) *(p.13)*[1] | 12.5 |
| 421-482 | Analysis & Design-Environmental Systems *(p.13)* | 12.5 |
| Elective[2] | | 12.5 |

1. This subject may be taken year-long in exceptional circumstances.
2. Electives should be chosen from the list approved and published on the Department web site. Requests to take subjects in addition to this can be made to the Head of Department.

## Bachelor of Engineering (Engineering Management) Environmental

The course structure below represents the core content for the Environmental Engineering specialisation of the BE (Engineering Management) degree. The course structure for later years of this course will be published as they become available for study (i.e. fourth year structure will be in the 2008 *Handbook*) All students should check that they have taken the listed subjects, or equivalent. For further information and up-to-date course advice students should regularly check the Department of Civil and Environmental Engineering's course advice page at <http://www.civenv.unimelb.edu.au/undergraduate>.

When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that departmental guidelines on electives are satisfied (see <http://www.civag.unimelb.edu.au/undergraduate>). Moreover, electives should be chosen so as to develop a specialisation, while ensuring a logical progression of year level and prerequisites. Students should also avoid timetable clashes in choosing their electives. In particular, students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

| First year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-103 | Engineering Statics *(p.8)* | 12.5 |
| 421-106 | Engineering Communication & Computing *(p.8)* | 12.5 |
| 610-141 | Chemistry A *(p.2)* | 12.5 |
| 620-141 | Mathematics A *(p.5)* | 12.5 |
| or | | |
| 620-121 | Mathematics A (Advanced) *(p.4)* | 12.5 |
| **Semester 2** | | |
| 421-107 | Environmental Engineering Introduction *(p.8)* | 12.5 |
| 325-101 | Managing People and Organisations *(p.1)* | 12.5 |
| 610-142 | Chemistry B *(p.2)* | 12.5 |
| 620-143 | Applied Mathematics *(p.5)* | 12.5 |
| or | | |
| 620-123 | Applied Mathematics (Advanced) *(p.4)* | 12.5 |
| **Second year** | | Points |
| **Semester 1** | | |
| 121-018 | Geomorphology *(p.3)* | 12.5 |
| 421-210 | Environmental Engineering - Basics *(p.9)* | 12.5 |
| 421-258 | Engineering Business Management *(p.10)* | 12.5 |
| 431-201 | Engineering Analysis A *(p.11)* | 12.5 |
| **Semester 2** | | |
| 421-209 | Geomechanics 1 *(p.9)* | 12.5 |
| 431-202 | Engineering Analysis B *(p.12)* | 12.5 |
| 610-280 | Environmental Chemistry *(p.5)* | 12.5 |
| Commerce subject* | | 12.5 |

* Commerce subject must be a level-100 and the prerequisites met where necesssary

| Third year | | Points |
|---|---|---|
| **Semester 1** | | |
| 121-021 | Environmental Politics and Management *(p.3)* | 12.5 |
| 421-305 | Engineering Hydraulics 1 *(p.10)* | 12.5 |
| 421-325 | Field Data Acquisition and Analysis *(p.11)* | 12.5 |
| 421-358 | Technoeconomic Decision Making *(p.11)* | 12.5 |
| **Semester 2** | | |
| 421-316 | Engineering Hydraulics & Hydrology *(p.10)* | 12.5 |
| 421-322 | Environmental Engineering Design 1 *(p.11)* | 12.5 |
| 421-327 | Computing for Land and Spatial Systems *(p.11)* | 12.5 |
| Commerce subject* | | 12.5 |

* Commerce subject must be a level-200 or level-300 and the prerequisites met where necesssary

## Bachelor of Arts/Bachelor of Engineering (Environmental) (BA/BE)

Students studying the BA/BE degree should consult the BE single degree course structure for a current list of core engineering subjects. The following exceptions are applicable to the BA/BE degree:

- 620-141 Mathematics A and 620-143 Applied Mathematics may be replaced by 620-121 Mathematics A (Advanced) and 620-123 Applied Mathematics (Advanced) with permission of Department of Mathematics and Statistics;
- 121-021 Environmental Politics and Management and 121-018 Geomorphology may be counted as arts points.

Students should regularly check the Department of Civil and Environmental Engineering's course advice page for additional information and up-to-date course advice at <http://www.civenv.unimelb.edu.au/undergraduate>.

When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

| First year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-106 | Engineering Communication & Computing *(p.8)* | 12.5 |

| First year | | Points |
|---|---|---|
| 620-141 | Mathematics A *(p.5)* | 12.5 |
| or | | |
| 620-121 | Mathematics A (Advanced) *(p.4)* | 12.5 |
| Arts subjects as required | | 25 |
| **Semester 2** | | |
| 421-107 | Environmental Engineering Introduction *(p.8)*[1] | 12.5 |
| 620-123 | Applied Mathematics (Advanced) *(p.4)* | 12.5 |
| or | | |
| 620-143 | Applied Mathematics *(p.5)* | 12.5 |
| Arts subjects as required | | 25 |

1. One week field camp prior to start of semester (see subject descriptions for futher details)

| Second year | | Points |
|---|---|---|
| **Semester 1** | | |
| 610-141 | Chemistry A *(p.2)* | 12.5 |
| 421-103 | Engineering Statics *(p.8)* | 12.5 |
| 431-201 | Engineering Analysis A *(p.11)* | 12.5 |
| 121-018 | Geomorphology *(p.3)* | 12.5 |
| **Semester 2** | | |
| 610-142 | Chemistry B *(p.2)* | 12.5 |
| 431-202 | Engineering Analysis B *(p.12)* | 12.5 |
| Arts subjects as required | | 25 |

| Third year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-210 | Environmental Engineering - Basics *(p.9)* | 12.5 |
| 421-255 | Management for Engineers 1 *(p.9)* | 12.5 |
| Arts subjects as required | | 25 |
| **Semester 2** | | |
| 421-209 | Geomechanics 1 *(p.9)* | 12.5 |
| 610-280 | Environmental Chemistry *(p.5)* | 12.5 |
| Arts subjects as required | | 25 |

| Fourth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 121-021 | Environmental Politics and Management *(p.3)* | 12.5 |
| 421-305 | Engineering Hydraulics 1 *(p.10)* | 12.5 |
| 421-325 | Field Data Acquisition and Analysis *(p.11)*[1] | 12.5 |
| 421-355 | Management for Engineers 2 *(p.11)* | 12.5 |
| **Semester 2** | | |
| 421-316 | Engineering Hydraulics & Hydrology *(p.10)* | 12.5 |
| 421-322 | Environmental Engineering Design 1 *(p.11)* | 12.5 |
| 121-227 | Spatial Informatics and GIS *(p.5)* | 12.5 |
| Arts subject as required | | 12.5 |

1. One week field camp prior to start of semester (see subject descriptions for futher details)

| Fifth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-453 | Engineering Systems Management *(p.12)* | 6.25 |
| 421-456 | Engineering Management 3E *(p.13)* | 6.25 |
| 421-490 | Quantification of Physical Processes A *(p.13)* | 12.5 |
| 421-491 | Quantification of Physical Processes B *(p.13)* | 12.5 |
| Arts subject as required | | 12.5 |
| **Semester 2** | | |
| 421-476 | Environmental Engineering Design 2 *(p.13)* | 12.5 |
| 421-477 | Research Project (Environmental) *(p.13)* | 12.5 |
| 421-482 | Analysis & Design-Environmental Systems *(p.13)* | 12.5 |
| Arts subject as required | | 12.5 |

## Bachelor of Engineering (Environmental)/Bachelor of Commerce (BE/BCom)

Students studying the BE/BCom degree should consult the BE single degree course structure for a current list of core engineering subjects. The following exceptions are applicable to the BE/BCom degree.

- 620-141 Mathematics A and 620-143 Applied Mathematics may be replaced by 620-121 Mathematics A (Advanced) and 620-123 Applied Mathematics (Advanced) with permission of Department of Mathematics and Statistics.
- 421-355 Management for Engineers 2 - exempt for students who complete 732-103 Principles of Business Law and 306-107 Accounting Reports and Analysis as part of the BCom. In order to complete the degree in 500 points, this exemption should be used.

Students should regularly check the Department of Civil and Environmental Engineering's course advice page for additional information and up-to-date course advice at <http://www.civenv.unimelb.edu.au/undergraduate>.

When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

| First year | | Points |
|---|---|---|
| **Semester 1** | | |
| 316-102 | Introductory Microeconomics *(p.1)* | 12.5 |
| 421-106 | Engineering Communication & Computing *(p.8)* | 12.5 |
| 620-141 | Mathematics A *(p.5)* | 12.5 |
| or | | |
| 620-121 | Mathematics A (Advanced) *(p.4)* | 12.5 |
| 732-103 | Principles of Business Law *(p.1)*[1] or other commerce subject | 12.5 |
| **Semester 2** | | |
| 316-101 | Introductory Macroeconomics *(p.1)* | 12.5 |
| 316-130 | Quantitative Methods 1 *(p.1)* | 12.5 |
| 421-107 | Environmental Engineering Introduction *(p.8)*[2] | 12.5 |
| 620-143 | Applied Mathematics *(p.5)* | 12.5 |
| or | | |
| 620-123 | Applied Mathematics (Advanced) *(p.4)* | 12.5 |

1. The Department of Civil and Environmental Engineering strongly recommends that BE/BCom students (environmental stream) take this subject as part of the BCom.
2. One week field camp prior to start of semester. (See subject descriptions for futher details.)

| Second year | | Points |
|---|---|---|
| **Semester 1** | | |
| 316-205 | Introductory Econometrics *(p.1)* | 12.5 |
| 610-141 | Chemistry A *(p.2)* | 12.5 |
| 421-103 | Engineering Statics *(p.8)* | 12.5 |
| 431-201 | Engineering Analysis A *(p.11)* | 12.5 |
| **Semester 2** | | |
| 610-142 | Chemistry B *(p.2)* | 12.5 |
| 431-202 | Engineering Analysis B *(p.12)* | 12.5 |
| Commerce subjects as required | | 25 |

| Third year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-210 | Environmental Engineering - Basics *(p.9)* | 12.5 |
| 421-255 | Management for Engineers 1 *(p.9)* | 12.5 |
| 121-018 | Geomorphology *(p.3)* | 12.5 |
| Commerce subjects as required | | 12.5 |
| **Semester 2** | | |
| 421-209 | Geomechanics 1 *(p.9)* | 12.5 |
| 610-280 | Environmental Chemistry *(p.5)* | 12.5 |
| Commerce subjects as required | | 25 |

| Fourth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-305 | Engineering Hydraulics 1 *(p.10)* | 12.5 |
| 421-325 | Field Data Acquisition and Analysis *(p.11)* | 12.5 |
| Commerce subjects as required | | 25 |
| **Semester 2** | | |
| 421-316 | Engineering Hydraulics & Hydrology *(p.10)* | 12.5 |
| 421-322 | Environmental Engineering Design 1 *(p.11)* | 12.5 |
| 421-327 | Computing for Land and Spatial Systems *(p.11)* | 12.5 |
| Commerce subject as required | | 12.5 |

| Fifth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-490 | Quantification of Physical Processes A *(p.13)* | 12.5 |
| 421-491 | Quantification of Physical Processes B *(p.13)* | 12.5 |
| Commerce subject as required | | 25 |
| **Semester 2** | | |
| 421-476 | Environmental Engineering Design 2 *(p.13)* | 12.5 |
| 421-477 | Research Project (Environmental) *(p.13)* | 12.5 |
| 421-482 | Analysis & Design-Environmental Systems *(p.13)* | 12.5 |
| Commerce subject as required | | 12.5 |

## Bachelor of Laws/Bachelor of Engineering (Environmental) (LLB/BE)

Students studying the BE/LLB degree should consult the BE single degree course structure for a current list of core engineering subjects. The following exceptions are applicable to the BE/LLB degree.

- 421-107 Environmental Engineering Introduction - exempt for students studying the BE/LLB.
- 620-141 Mathematics A and 620-143 Applied Mathematics may be replaced by 620-121 Mathematics A (Advanced) and 620-123 Applied Mathematics (Advanced) with permission of Department of Mathematics and Statistics.
- Students who commenced first year prior to 1998 should seek individual advice on subject equivalence in the old course structure.

Students should regularly check the Department of Civil and Environmental Engineering's course advice page for additional information and up-to-date course advice at <http://www.civenv.unimelb.edu.au/undergraduate>.

When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

| First year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-106 | Engineering Communication & Computing *(p.8)* | 12.5 |
| 620-141 | Mathematics A *(p.5)* | 12.5 |
| or | | |
| 620-121 | Mathematics A (Advanced) *(p.4)* | 12.5 |
| 730-111 | Legal Method and Reasoning *(p.1)* | 12.5 |
| 730-112 | Principles of Public Law *(p.1)* | 12.5 |
| **Semester 2** | | |
| 421-107 | Environmental Engineering Introduction *(p.8)* | 12.5 |
| 620-143 | Applied Mathematics *(p.5)* | 12.5 |
| or | | |
| 620-123 | Applied Mathematics (Advanced) *(p.4)* | 12.5 |
| 730-113 | Dispute Resolution *(p.1)* | 12.5 |
| 730-114 | Torts *(p.1)* | 12.5 |

| Second year | | Points |
|---|---|---|
| **Semester 1** | | |
| 431-201 | Engineering Analysis A *(p.11)* | 12.5 |
| 610-141 | Chemistry A *(p.2)* | 12.5 |
| 730-212 | Legal Theory *(p.2)* | 12.5 |
| 730-213 | Obligations *(p.2)* | 12.5 |
| **Semester 2** | | |
| 431-202 | Engineering Analysis B *(p.12)* | 12.5 |
| 610-142 | Chemistry B *(p.2)* | 12.5 |
| 730-214 | Constitutional Law *(p.2)* | 12.5 |
| 730-215 | Contracts *(p.2)* | 12.5 |

| Third year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-103 | Engineering Statics *(p.8)* | 12.5 |
| 421-210 | Environmental Engineering - Basics *(p.9)* | 12.5 |
| 421-255 | Management for Engineers 1 *(p.9)* | 12.5 |
| 730-366 | Property *(p.3)* | 12.5 |
| **Semester 2** | | |
| 421-209 | Geomechanics 1 *(p.9)* | 12.5 |
| 610-280 | Environmental Chemistry *(p.5)* | 12.5 |
| 730-367 | Trusts *(p.3)* | 12.5 |
| 730-368 | Criminal Law and Procedure *(p.4)* | 12.5 |

| Fourth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-305 | Engineering Hydraulics 1 *(p.10)* | 12.5 |
| 421-325 | Field Data Acquisition and Analysis *(p.11)* | 12.5 |
| 121-018 | Geomorphology *(p.3)* | 12.5 |
| 730-365 | Administrative Law *(p.3)* | 12.5 |
| **Semester 2** | | |
| 421-316 | Engineering Hydraulics & Hydrology *(p.10)* | 12.5 |
| 421-322 | Environmental Engineering Design 1 *(p.11)* | 12.5 |
| 421-327 | Computing for Land and Spatial Systems *(p.11)* | 12.5 |
| 730-453 | Remedies *(p.4)* | 12.5 |

| Fifth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-490 | Quantification of Physical Processes A *(p.13)* | 12.5 |
| 421-491 | Quantification of Physical Processes B *(p.13)* | 12.5 |
| 730-445 | Environmental Law *(p.10)* | 12.5 |
| Law subject as required | | 12.5 |
| **Semester 2** | | |
| 421-476 | Environmental Engineering Design 2 *(p.13)* | 12.5 |
| 421-477 | Research Project (Environmental) *(p.13)* | 12.5 |
| 421-482 | Analysis & Design-Environmental Systems *(p.13)* | 12.5 |
| 730-454 | Legal Ethics *(p.4)*[1] | 12.5 |

1. This subject may be taken in Semester 1 in exceptional circumstances.

| Sixth year | | Points |
|---|---|---|
| Law subjects as approved to meet requirements of LLB (total of 300 points) | | 100 |

## Bachelor of Engineering (Environmental)/Bachelor of Science (BE/BSc)

Students studying the BE/BSc degree should consult the BE single degree course structure for a current list of the core engineering subjects. The following exceptions are applicable to the BE/BSc degree:

- 620-141 Mathematics A and 620-143 Applied Mathematics may be replaced by 620-121 Mathematics A (Advanced) and 620-123 Applied Mathematics (Advanced) with the permission of the Department of Mathematics and Statistics.
- Any subject listed as core for engineering can count towards science points provided that subject is listed in the Faculty of Science section of the *Handbook*.
- The order of subjects taken may be varied as long as prerequisites are observed.

Students should regularly check the Department of Civil and Environmental Engineering's course advice page for additional information and up-to-date course advice at <http://www.civenv.unimelb.edu.au/undergraduate>.

When setting the timetable every effort will be made to avoid clashes between the times of classes associated with these sets of subjects. Students should be aware however, that if it proves to be impossible to achieve a timetable without clashes in these sets of subjects, the Faculty reserves the right to modify course structures in order to eliminate the conflicts. Students will be advised during the enrolment period of the semester if the recommended courses need to be varied. Where the courses include elective subjects these should be chosen so that timetable clashes are avoided. In particular, students in combined degrees should plan their courses so that the subjects chosen in the other faculty do not clash with those recommended for the engineering component.

| First year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-103 | Engineering Statics *(p.8)* | 12.5 |
| 421-106 | Engineering Communication & Computing *(p.8)* | 12.5 |
| 610-141 | Chemistry A *(p.2)* | 12.5 |
| 620-141 | Mathematics A *(p.5)* | 12.5 |
| or | | |
| 620-121 | Mathematics A (Advanced) *(p.4)* | 12.5 |
| **Semester 2** | | |
| 421-107 | Environmental Engineering Introduction *(p.8)* | 12.5 |
| 610-142 | Chemistry B *(p.2)* | 12.5 |
| 620-143 | Applied Mathematics *(p.5)* | 12.5 |
| or | | |
| 620-123 | Applied Mathematics (Advanced) *(p.4)* | 12.5 |
| Science subject as required | | 12.5 |

| Second year | | Points |
|---|---|---|
| **Semester 1** | | |
| 431-201 | Engineering Analysis A *(p.11)* | 12.5 |
| or | | |
| 620-231 | Vector Analysis *(p.7)*[1] | 12.5 |
| 421-255 | Management for Engineers 1 *(p.9)* | 12.5 |
| 421-210 | Environmental Engineering - Basics *(p.9)* | 12.5 |
| 121-018 | Geomorphology *(p.3)*[2] | 12.5 |
| **Semester 2** | | |
| 421-209 | Geomechanics 1 *(p.9)* | 12.5 |
| 431-202 | Engineering Analysis B *(p.12)* | 12.5 |
| or | | |
| 620-232 | Mathematical Methods *(p.7)* | 12.5 |
| 610-280 | Environmental Chemistry *(p.5)* | 12.5 |
| Science subject as required | | 12.5 |

1. Students intending to take 200-level Faculty of Science mathematics subjects should include in their science subject selection 620-194 Mathematics B. (Advanced) or 620-192 Mathematics B in order to meet prerequisite requirements.
2. Or another science subject.

| Third year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-305 | Engineering Hydraulics 1 *(p.10)* | 12.5 |
| 421-325 | Field Data Acquisition and Analysis *(p.11)* | 12.5 |
| 421-355 | Management for Engineers 2 *(p.11)* | 12.5 |
| Science subject as required | | 12.5 |
| **Semester 2** | | |
| 421-316 | Engineering Hydraulics & Hydrology *(p.10)* | 12.5 |
| 421-322 | Environmental Engineering Design 1 *(p.11)* | 12.5 |
| 421-327 | Computing for Land and Spatial Systems *(p.11)* | 12.5 |
| Science subject as required | | 12.5 |

| Fourth year | | Points |
|---|---|---|
| **Semester 1** | | |
| 421-453 | Engineering Systems Management *(p.12)* | 6.25 |
| 421-456 | Engineering Management 3E *(p.13)* | 6.25 |
| 421-490 | Quantification of Physical Processes A *(p.13)* | 12.5 |
| 421-491 | Quantification of Physical Processes B *(p.13)* | 12.5 |
| Science subject as required | | 12.5 |
| **Semester 2** | | |
| 421-476 | Environmental Engineering Design 2 *(p.13)* | 12.5 |
| 421-477 | Research Project (Environmental) *(p.13)* | 12.5 |
| 421-482 | Analysis & Design-Environmental Systems *(p.13)* | 12.5 |
| Science subject as required | | 12.5 |

| Fifth year | | Points |
|---|---|---|
| Science subjects as required | | 75 |
| 121-021 | Environmental Politics and Management *(p.3)* | 12.5 |
| Engineering subject as required | | 12.5 |

# Subject descriptions

### 121-018 Geomorphology

See full subject details on page 3.

### 121-021 Environmental Politics and Management

See full subject details on page 3.

### 316-101 Introductory Macroeconomics

See full subject details on page 1.

### 316-102 Introductory Microeconomics

See full subject details on page 1.

### 316-205 Introductory Econometrics

See full subject details on page 1.

### 316-130 Quantitative Methods 1

See full subject details on page 1.

### 421-101 Civil Engineering Introduction

**Credit points: 12.5**

**Coordinator:** Assoc Prof Nick Haritos

**Prerequisites:** Subject assumes knowledge of VCE Mathematical Methods units 3 and 4.

**Contact:** 36 hours of lectures and 12 hours of practice *(Semester 2).*

**Description:** Topics covered include the history and role of civil engineering in society, the relationship between science and engineering, the environmental and sustainability issues surrounding engineering projects, an introduction to the various sub-disciplines of civil engineering, the components of a civil engineering project, and case study examples of projects.

**Assessment:** A 3-hour examination (60%) and 4 assignments to be held throughout the semester each up to 2000 words (40%). Students must submit all assignments and achieve a grade of at least 50% in the examination in order to pass the subject.

**Prescribed texts:** J S Scott, *A Dictionary of Civil Engineering*, 4th edition, Penguin, 1991.

### 421-103 Engineering Statics

**Credit points: 12.5**

**Coordinator:** Professor Graham Hutchinson

**Prerequisites:** Subject assumes knowledge of VCE Mathematical Methods units 3 & 4.

**Contact:** Thirty-six hours of lectures and twelve hours of tutorials *(Semester 1, repeat Summer).*

**Description:** Topics covered include force systems; resolution of forces including moments of a force, couples, moments of distributed forces; equilibrium, support systems; shear force, bending moments in beams; forces in pin-connected trusses; equilibrium concepts via virtual work; stress, strain, elasticity in one and two dimensions; stress transformation; stress and deflection caused by bending and torsion; indeterminate systems; the stresses in a fluid at rest; hydrostatic distribution of pressure; Archimedes' principle; projected areas; hydrostatic stability and metacentric height.

**Assessment:** A 3-hour written examination (70%) and two assignments of not more than 2000 words each (30%).

**Prescribed texts:** J L Meriam and L G Kraige, *Engineering Statics, Vol 1 - Statics*, 4th edition, Wiley, 1992.

### 421-106 Engineering Communication & Computing

**Credit points: 12.5**

**Coordinator:** Prof G L Hutchinson

**Prerequisites:** Subject assumes knowledge of VCE Mathematical Methods units 3 and 4.

**Contact:** Twenty-four hours lectures and 24 hours of practice classes *(Semester 1).*

**Description:** This subject is intended to develop oral, written, numerical and graphical communication skills and assist students in the transition of tertiary studies. The media for that development will be library and database facilities, word processing, computational, spreadsheet and drawing software packages. The course will develop research skills and the ability to cite and incorporate other work; it will develop basic numerical knowledge and apply that knowledge in the use of computational packages, including spreadsheets for engineering applications and research. The subject will also develop skills in the presentation of that knowledge in the form of reports, and will develop professional skills in computer-aided drafting and the interpretation and use of engineering drawings. The subject will also develop group interaction skills, generic skills attributes and incorporate a transition program.

**Assessment:** A process of continuous assessment by six short tests (10% for 1 + 40% for the remainder) plus two assignments of 2000 words or equivalent (30% + 20%). Both assignments are due in the second half of the semester. Students must submit all assignments and achieve an aggregate grade of at least 50% in the tests in order to pass the subject.

### 421-107 Environmental Engineering Introduction

**Credit points: 12.5**

**Coordinator:** Dr G Moore

**Contact:** Twelve hours of lectures and 36 hours of field work. Students must attend a field camp July 16th- July 21st, 2007 *(Semester 2).*

**Description:** The subject traces the evolution of engineering and its development beyond military and civil engineering into further disciplines and narrower specialities in response to the growth of experience, knowledge, understanding and application. The subject will provide a framework to demonstrate the function and responsibility of environmental engineers in a broad range of engineering projects through examination of the role of engineers; their relationship to society and its organisations; their utilisation of resources; their application of ideas, principles and techniques; the medium in which they perform; and their interaction with each other and organisations. Much of the teaching will be interactive and utilise exposure to live projects observed during a comprehensive field visit. Development of a qualitative conceptual understanding of the principle laws of engineering science will be emphasised.

**Assessment:** 2-hour written end-of-semester examination (50%) and 1 assignment totalling 2000 words (50%). Field class participation and verbal skills will form a component the assignment.

**Prescribed texts:** S Beder, *The Nature of Sustainable Development*, Scribe Publications, Newham, Victoria, 1996.

### 421-112 Dynamics and Measurement Systems

**Credit points: 12.5**

**Coordinator:** A/Prof N. Haritos

**Prerequisites:** 421-103 Engineering Statics.

**Contact:** Thirty-two hours of lectures, 12 hours of tutorials, 4 hours of practice classes *(Semester 2).*

**Description:** Topics covered include: Newton's laws of motion for a particle in inertial reference frames; conservation of energy (kinetic and potential), linear momentum and angular momentum; the motion of a rigid body including the conservation laws; the dissipation of energy and the conversion of energy to heat; the analysis of motion of constrained and unconstrained bod-

ies; the determination of frequencies of motion of a pendulum, a simple spring-mass system, a string and simple flexural systems; the response of undamped and damped single-degree-of-freedom systems to a variety of input and/or initial conditions using classical and numerical modelling techniques; introduction to multi-degree-of-freedom systems; shear stress in a fluid in motion with an emphasis on Newtonian fluids; description of laminar and turbulent flows and the importance of Reynolds number; the basic principles and design of measurement transducers (strain gauges, LVDTs, pressure transducers, accelerometers, etc) and other systems of measurement; principles and techniques for data acquisition and data logging using measurement transducers; the design of experiments using measurement systems.

**Assessment:** A 2-hour examination (60%) and progressive assessment based upon 5 quizzes and 3 assignments each up to 2000 words, to be held throughout the semester (40%). Students must submit all assignments and quizzes and achieve a grade of at least 50% in the examination in order to pass the subject.

## 421-121 Materials 1

**Credit points: 12.5**

**Coordinator:** TBA

**Prerequisites:** Nil

**Contact:** Thirty-six hours of lectures, 12 hours of tutorials *(Semester 1).*

**Description:** This subject describes the chemical principles required for a fundamental understanding of engineering materials and related processes, including in-service durability. There is a strong emphasis on relating the chemical principles to applications of interest in civil and environmental engineering, thereby illustrating the importance of fundamental theoretical knowledge in everyday processes and applications.

**Assessment:** Progressive assessment (based on case studies and written assignments), to a maximum of 3000 words or equivalent (30%), and one 3-hour end of semester examination (70%).

## 421-122 Materials 2

**Credit points: 12.5**

**Coordinator:** Assoc Prof Nelson Lam

**Contact:** Forty-eight hours of lectures and tutorials *(Semester 2).*

**Description:** Topics covered include: engineering materials such as metals (including steel, aluminium, titanium), ceramic and glasses (including concrete), polymers and composites (including timer) and nano-materials. The basic physical properties of these materials on both the molecular scale and the structural scale are presented (encompassing composition of the materials, phase transitions and mechanical properties). the concepts of material failure, including fracture, fatigue and creep, are introduced. The corrosion and degradation of materials exposed to environmental conditions are presented. the manufacturing and engineering application of selected construction materials, including steel, aluminium, concrete and bricks, will be introduced and integrated with the fundamental concepts described above.

**Assessment:** One 3-hour end of semester examination (70%), and practical work consisting of two assignments, of up to 1000 and 2000 words respectively (30%).

## 421-207 Introduction to Design

**Credit points: 12.5**

**Coordinator:** Emad Gad

**Prerequisites:** 421-107 Environmental Engineering Introduction or 421-101 Civil Engineering Introduction

**Contact:** Forty-eight hours of lectures and tutorials *(Semester 2).*

**Description:** The subject content is as follows: techniques for problem definition; nature of infrastructure systems and their sub-systems; conceptual modelling of systems; conceptual design and creative thinking; planning methodology; function; and performance, failure and reliability, communication by reports and plans. Topics include: infrastructure and natural systems; economy and life cycles costs; planning and designing; design objectives: function, aesthetics, costs, serviceability, safety; analysis and synthesis; conceptual design; uncertainties: variably, inaccuracy, mistakes; standardisation of materials, load calculations and procedures; government and other regulation; philosophies of design: allowable stress design, limit states design; and detailing and documentation: computations and iterative design, drawing conventions.

**Assessment:** One 3-hour end of semester exam (60%). Three in-class conceptual design group reports over the first 8 weeks of semester (10%). Three 600 word reports spread over the semester (15%) and one 2000 (per student) word group end-of-semester report (15%).

## 421-208 Mechanics of Solids

**Credit points: 12.5**

**Coordinator:** Dr H Goldsworthy

**Prerequisites:** 421-103 Engineering Statics

**Contact:** Thirty-three hours of lectures, twelve hours of practice classes and six hours of laboratory classes *(Semester 1).*

**Description:** Topics covered in this subject build on the basic knowledge obtained in statics, and are organised into 3 components: structural analysis; analysis of sectional behavior when subjected to a bending moment, axial force, shear force or torque; and buckling of elements.

**Assessment:** One 3-hour written end of semesster examination (75%) and practice classes and laboratory work (25%).

## 421-209 Geomechanics 1

**Credit points: 12.5**

**Coordinator:** Mr.J.Styles/ Dr.S.Yuen

**Prerequisites:** 421-103 Engineering Statics.

**Contact:** Forty-two hours of lectures and tutorials, six hours of laboratory classes *(Semester 2).*

**Description:** Topics include soil and rock identification, mineral composition and classification; discontinuities in rock masses; water in soil; principle of effective stress; stress transmission; confined and unconfined flow of water through soils; Darcy's law, seepage; dispersive and swelling soils; compressibility of soil and settlement of structures; consolidation; strength of soils and rocks; earch pressure; and active, passive and at-rest earch pressures. applications in environmental engineering and civil engineering.

**Assessment:** One 3-hour end of semester written examination (70%), two assignments of up to 2000 words each due at half and two-thirds of the way through the semester (20%), together with two laboratory reports of up to 1000 words each scheduled throughout the semester (10%).

## 421-210 Environmental Engineering - Basics

**Credit points: 12.5**

**Coordinator:** Dr L Aye

**Contact:** Thirty lectures, 4 tutorials, 4 hours computer labs, 6 hours design classes; and 1 site visit *(Semester 1).*

**Description:** An introduction to structure, function and reproduction of living cells, tissues and organisms. Plant physiology. Microbiology and its application to waste treatment.An introduction to heat transfer in the natural and built environment.Techniques for problem definition in environmental engineering; nature of environmental engineering systems and their sub-systems; conceptual modelling of systems; conceptual design and creative thinking; planning methodology; function; performance, failure and reliability, communication by reports plans. Economy and life-cycles costs.

**Assessment:** One end of semester examination 2-hours (60%); Three in-class conceptual design group reports over the first 8 weeks of semester (10%); One mid semester test of 1 hr (15%); Up to three on-line quizzes totalling less than 1 hour in the latter third of semester (5%); three practical reports of no more than 500 words each spread over the semester (10%). Attendance at excursions is compulsory.

## 421-255 Management for Engineers 1

**Note:** Students enrolled in the Bachelor of Engineering (Civil or Environmental) are required to enrol into 421-255. Students enrolled in the Bachelor of Engineering (Management) are required to enrol into 421-258. Students may only gain credit for one of 421-255 or 421-258 Engineering Business Management

**Credit points: 12.5**

**Contact:** Thirty hours of lectures, eighteen hours of practice classes *(Semester 1).*

**Description:** On completion of this subject students should understand:

- the relevance of the discipline of management to engineering and some core techniques of management, including programming and scheduling;
- origins and development of Australian engineering organisations, the engineer and professional practice, professional ethics and engineers, the functions of the professional societies, engineers in government-national, state and local;
- case studies in engineering practice and technological innovation discussing the management process, embracing planning, organisation, leadership and control of human, physical and financial resources in public and private sector;
- engineering management including responsibility, authority, human relations, industrial relations, quality and environmental management systems including consideration of the ISO 9000 and 14000 series requirements.

**Assessment:** One written end of semester examination 3-hours (70%) and assignments totalling 4000 words (30%) due throughout the semester.

## 421-258 Engineering Business Management

**Note:** Students enrolled in the Bachelor of Engineering (Management) are required to enrol into 421-258. Students enrolled in the Bachelor of Engineering (Civil or Environmental) are required to enrol into 421-255. Students may only gain credit for one of 421-258 or 421-255 Management for Engineers 1

**Credit points: 12.5**

**Contact:** Thirty hours of lectures, eighteen hours of practice classes *(Semester 1).*

**Description:** On completion of this subject students should understand:

- the relevance of the discipline of management to engineering and some core techniques of management, including programming and scheduling;
- origins and development of Australian engineering organisations, the engineer and professional practice, professional ethics and engineers, the functions of the professional societies, engineers in government-national, state and local;
- case studies in engineering practice and technological innovation discussing the management process, embracing planning, organisation, leadership and control of human, physical and financial resources in public and private sector;
- engineering management including responsibility, authority, human relations, industrial relations, quality and environmental management systems including consideration of the ISO 9000 and 14000 series requirements.

**Assessment:** One written end of semester examination 3-hours (70%) and assignments totalling 4000 words (30%) due throughout the semester.

## 421-305 Engineering Hydraulics 1

**Credit points: 12.5**

**Coordinator:** Assoc Prof R Hughes

**Prerequisites:** 421-103 Engineering Statics.

**Contact:** Thirty-three hours of lectures, 11 hours of tutorials and four hours of laboratory *(Semester 1).*

**Description:** At the conclusion of this subject students should have acquired an appreciation of problems involving fluids at rest and in motion and have developed a sound understanding of engineering hydraulics as applied to environmental and civil engineering situations.

Topics covered include fluid statics and kinematics of fluid motion; Bernoulli's equation, application of physical laws in solving flow problems via control volumes (involving the conservation equations of mass and momentum, the energy equation); dynamic similitude, dimensional analysis and physical scale modelling; flow in pipes, rotordynamic pumps, simple pipeline systems, pressure surges in pipes, discharge measurements in pipes; and flow past immersed bodies (introduction to boundary layer theory, lift and drag on immersed bodies).

**Assessment:** One written examination of 3-hour duration at the conclusion of the subject (85%) and one formal report on a 1-hour long experiment (15%) in the second half of the semester.

## 421-306 Geotechnical Engineering

**Credit points: 12.5**

**Coordinator:** Dr S Yuen

**Prerequisites:** 421-209 Geomechanics 1

**Contact:** Thirty hours of lectures, 18 hours of tutorials and problem solving sessions *(Semester 1).*

**Description:** Students completing this unit should understand how to make simplifications to complex soil conditions, how to establish strength/deformation characteristics of the soil and how to apply fundamental geomechanics knowledge learned in earlier units to solve problems involving the stability of an earth mass.

Topics covered include design of earth retaining structures; stability of slopes, seepage analysis, settlement and bearing capacity of shallow footings; site investigation and limit state design in geotechnical engineering.

**Assessment:** One 3-hour end of semester written examination (60%), together with three assignments of 2000 words each due throughout the semester (40%). A grade of 40% out of the 60% written examination must be attained in order to pass the subject.

## 421-307 Structural Engineering 1

**Credit points: 12.5**

**Coordinator:** Assoc Prof Nelson Lam

**Prerequisites:** 421-208 Mechanics of Solids or equivalent

**Contact:** Twenty-six hours of lectures, 18 hours of tutorial design sessions and four hours of laboratory work *(Semester 1).*

**Description:** At the conclusion of this subject students should be able to analyse for internal actions and deformations in simple truss and frame structure members arising from a variety of loading states. In addition, students will be able to carry out designs of reinforced and prestressed concrete frames consisting of beams and columns.

Topics covered include elements of structural behaviour; basic modes of structural action; analysis of statically determinate systems and stability using a variety of approaches; flexural strength theory of structural concrete members with passive and/or active reinforcement, shear, deflection, anchorage and stress development; strength theory of reinforced concrete columns, including the use of interaction diagrams and loading lines to deal with slenderness effects; and concrete design project.

**Assessment:** One 3-hour examination (80%), and practical work consisting of two assignments, each up to 750 words, and a design project of up to 3000 words, to be held throughout the semester (20%).

## 421-316 Engineering Hydraulics & Hydrology

**Credit points: 12.5**

**Coordinator:** Assoc Prof R L Hughes

**Prerequisites:** 421-305 Engineering Hydraulics 1.

**Contact:** Thirty-one hours of lectures, 14 hours of practice classes and three hours of laboratory work *(Semester 2).*

**Description:** At the conclusion of this subject students should be capable of solving a wide range of commonly encountered hydraulic problems in rivers and canals and will have acquired a user-oriented knowledge in engineering hydrology with sufficient theory to allow them to pursue further study in the field.

Topics covered include the energy momentum principles and their application to a variety of open channel flow problems: uniform flow; unsteady flow in open channels, including the long wave equations and flood propagation by diffusion and kinematic routing; steady gradually-varied flow and the numerical calculation of surface profiles; rigid-boundary and erodible channels and sediment transport in rivers and canals; measurement of discharge; risk probability in hydrology and engineering works; the hydrologic cycle; streamflow and its measurement; flood frequency analysis; estimating flood hydrographs; estimating yield; stochastic data generation; design rainfalls and the 'rational method' with particular application to urban drainage systems and their design; and groundwater, with confined and unconfined aquifers and steady and unsteady well hydraulics.

**Assessment:** One written examination of 3-hours duration at the conclusion of the subject (80%), one formal report on a one hour long experiment (10%) in the second half of the semester and one assignment of 2000 to 3000 words in the second half of the semester (10%).

## 421-317 Structural Engineering 2

**Credit points: 12.5**

**Coordinator:** Assoc Prof N Haritos

**Prerequisites:** 421-307 Structural Engineering 1.

**Contact:** Thirty hours of lectures, 15 hours of practice classes and 3 hours of laboratory work *(Semester 2).*

**Description:** At the conclusion of this subject students should be able to analyse for internal actions and deformations in both determinate and indeterminate truss and frame structure members arising from a variety of loading states. On completion of the design component students will be able to apply techniques previously introduced to the design of members and connections for a variety of steel structures.

Topics covered include an introduction to computer analysis of determinate and indeterminate truss and frame structures using matrix methods; introduction to the finite element technique; modelling of the basic modes of structural action; and behaviour (first order and second order) of ties, columns, beams, beam-columns, simple frames, bolts, welds and fasteners groups including yielding, fracture, buckling and warping.

**Assessment:** A 3-hour end-of-semester examination (80%), and practical work consisting of two computer laboratory assignments, each up to 750 words, and a design project up to 3000 words, to be held throughout the semester (20%).

## 421-318 Construction Engineering

**Credit points: 12.5**

**Coordinator:** Prof D Young

**Prerequisites:** 421-207 Introduction to Design, 421-209 Geomechanics 1 and 421-305 Engineering Hydraulics 1

**Contact:** Thirty hours of lectures and 18 hours of practice classes and fieldwork *(Semester 2).*

**Description:** At the completion of this subject students should have an understanding of the roles of design, investigation and construction practices in the field of construction engineering.

Topics covered include site investigation; construction systems including foundations, cofferdams, earthwork, ground support, falsework and scaffold-

ing, formwork, plant and equipment; design aspects of construction systems, pavements and temporary works; plant selection including earthmoving equipment, tunnelling, cranage; and survey control methods for engineering construction above and below ground and water.

**Assessment:** One written 3-hour examination (60%) and assignments (40%) totalling 600 words spread throughout the semester.

## 421-322 Environmental Engineering Design 1

**Credit points: 12.5**

**Coordinator:** Dr G Moore

**Prerequisites:** 431-202 Engineering Analysis B and 421-210 Environmental Engineering.

**Contact:** A 1-day excursion (four hours), eight hours of lectures and 36 hours of tutorial/practical classes *(Semester 2).*

**Description:** The objective of this subject is to have students experience solving a substantial and realistic environmental engineering design problem working in groups and as individuals.

Topics covered include general issues relating to environmental engineering design including engineering design methodology; systems and optimisation; application of economic analysis; environmental and social considerations; sustainable development; environmental impact statements and assessments; public participation; international protocols, eg. Ramsar, Kyoto, Rio; and design projects, analysis and presentation of large data sets.

**Assessment:** One end-of-semester written report not exceeding 50 pages (60%). Up to six minor reports, assignments or multimedia presentations not exceeding 20 pages equivalent spread throughout the first 8 weeks of semester (35%). Four contributions to a reflective journal (5%)

## 421-325 Field Data Acquisition and Analysis

**Credit points: 12.5**

**Coordinator:** Dr. A Western

**Prerequisites:** 421-103 Engineering Statics, 421-210 Environmental Engineering, 431-202 Engineering Analysis B.

**Contact:** A 4-day field camp totalling 28 hours, plus a day of lectures will be held in the week prior to semester, 8 hours of lectures, 12 hours of tutorial/practical classes *(Semester 1).*

**Description:** At the conclusion of this subject students should be able to select, commission and use a range of electronic data aquisition devices. They should be familiar with some important instrumentation, sampling theory and field techniques and have an appreciation of how to use and interpret environmental measurements.

Topics covered include sampling principles, electric circuit laws, calibration and errors, standards, transducer physics, transducer selection, fault diagnostics, digital signal processing, measurement system design (including environmental, occupational health, data quality control, management, social and technical considerations) stream gauging, water quality evaluation, meteorological observation, land surface measurement, and stream condition and habitat assessment.

**Assessment:** Participation in (10%) and group reporting (600 words per student) on (15%) field activities during the pre-semester field camp, two written 30 minute tests during pre-semester field camp (5%), one written assignment of 1000 words to be submitted during the second week of semester (20%), two group assignments of 2000 words each to be submitted near the middle and the end of the semester (5% and 35% respectively), four reflective journals spaced throughout the semester (5%) and participation in an online discussion forum (5%) during the first 8 weeks of semester.

## 421-327 Computing for Land and Spatial Systems

**Credit points: 12.5**

**Coordinator:** Dr J P Walker

**Prerequisites:** 431-201 Engineering Analysis A, 431-202 Engineering Analysis B, 421-106 Engineering Communication and Computing

**Contact:** Twenty-four hours lectures, 24 hours computer labs, and a one-day (1st Saturday of non-teaching period) field trip *(Semester 2).*

**Description:** Topics covered include programming in a high level computer program language with specific emphasis on problem solving and application to environmental problems, use of remote sensing and geographical information systems in relation to environmental issues.

**Assessment:** A 2-hour end of semester written examination (35%) and assignments throughout the semester totalling 5000 words (65%). Students must attend the field trip and submit all assignments and achieve a grade of at least 50% in the examination in order to pass the subject.

## 421-355 Management for Engineers 2

**Note:** Students enrolled in the Bachelor of Engineering (Civil or Environmental)/Bachelor of Commerce are required to enrol into 421-356. Students enrolled in the Bachelor of Engineering (Civil or Environmental) are required to enrol into 421-355. Students may only gain credit for one of 421-356 or 421-355 Management for Engineers

**Credit points: 12.5**

**Coordinator:** Prof G L Hutchinson

**Contact:** Thirty-six hours of lectures and 12 hours of practice classes *(Semester 1).*

**Description:** On completion of this subject students should have an appreciation of the legal, economic and financial framework within which engineers must practise and the effect these factors play in planning an engineering project.

Engineering decision making within the framework of macro and microeconomics, supply and demand, budgetary and monetary policy.

Financial evaluation and analysis, and accounting principles, ledgers, profit and loss statements, balance sheets applied to engineering systems. Financial evaluation of Research and Development and technological innovation.

Introduction to law, contact, tort, project delivery systems and engineering contracts, liability and intellectual property corporations law, environmental law. An introduction to systems management, systems analysis, mathematical and linear programming.

**Assessment:** One three-hour written examination (70%) and assignments totalling not more than 5000 words, or equivalent (30%).

## 421-356 Management for Engineers 2C

**Note:** Students enrolled in the Bachelor of Engineering (Civil or Environmental)/Bachelor of Commerce are required to enrol into 421-356. Students enrolled in the Bachelor of Engineering (Civil or Environmental) are required to enrol into 421-355. Students may only gain credit for one of 421-356 or 421-355 Management for Engineers

**Credit points: 12.5**

**Coordinator:** Prof D. Young

**Prerequisites:** 421-255 Management for Engineers 1.

**Contact:** 36 hours lectures, 12 hours practice classes *(Semester 1).*

**Description:** At the completion of this subject, students should be able to: (i) apply management principles to the development of an environmental management system based on the ISO 1400 Standard for an environmental engineering project; (ii) appreciate the dynamics of small group interactions and teamwork in making presentations to, and in preparing reports (including a non-technical summary) for, senior management; and (iii) recognise the need for and practice of personnel skills ranging from making personal presentations, undertaking interviews and performance appraisals, providing good communication and managing human resources.

Introduction to law, contact, tort, project delivery systems and engineering contracts, liability and intellectual property corporations law, environmental law. An introduction to systems management, systems analysis, mathematical and linear programming.

**Assessment:** One written 3-hour end-of-semester examination (70%) and assignments totalling not more than 4500 words (30%).

## 421-358 Technoeconomic Decision Making

**Note:** Students enrolled in the Bachelor of Engineering (Management) are required to enrol into 421-358. Students enrolled in the Bachelor of Engineering (Civil or Environmental) are required to enrol into 421-355. Students may only gain credit for one of 421-358 or 421-355 Management for Engineers 1

**Credit points: 12.5**

**Semester:** Semester 1

**Description:** On completion of this subject students should have an appreciation of the legal, economic and financial framework within which engineers must practise and the effect these factors play in planning an engineering project.

Engineering decision making within the framework of macro and microeconomics, supply and demand, budgetary and monetary policy.

Financial evaluation and analysis, and accounting principles, ledgers, profit and loss statements, balance sheets applied to engineering systems. Financial evaluation of Research and Development and technological innovation.

Introduction to law, contact, tort, project delivery systems and engineering contracts, liability and intellectual property corporations law, environmental law. An introduction to systems management, systems analysis, mathematical and linear programming.

**Assessment:** One three-hour written examination (70%) and assignments totalling not more than 5000 words, or equivalent (30%).

## 421-401 Techniques of Research and Investigation

**Credit points: 6.25**

**Coordinator:** Dr R Thompson

**Prerequisites:** Successful completion of all core BE 3rd-year level subjects.

**Contact:** Eight hours of lectures and 16 hours of independent research *(Semester 1).*

**Description:** At the conclusion of this subject students should have the skills required to carry out the initial investigation required for a later more detailed research project or design. Topics covered include the research process; sources of information; written and oral presentation of research.

**Assessment:** Written report (up to 40 pages inclusive of diagrams and tables) or equivalent (95%) and a generic skills test (5%).

### 421-405 Management for Engineers 3

**Credit points: 12.5**

**Coordinator:** Prof D Young

**Prerequisites:** 421-255 Management for Engineers 1 and 421-355 Management for Engineers 2, or equivalents.

**Contact:** Thirty-six hours of lectures, twelve hours of practice classes and tutorials *(Semester 1).*

**Description:** On completion of this subject, students should have gained an understanding of the project and construction management aspects involved with the delivery of an engineering structure.

1. Project management concepts including feasibility studies, project financing, strategic planning, cash flow and cost control; quality assurance principles, standards and practice.

2. Estimating and tendering civil engineering construction works, including work breakdown structures, work method statements, risk identification and tendering principles; detailed study of contract documents for design and construction including various party responsibilities and authorities; and contract administration.

3. Human resource skills in the building and construction industry, including Occupational Health and Safety and Enterprise Bargaining practices.

**Assessment:** One 3-hour end of semester examination (70%) and a 4000 word assignment (30%).

### 421-410 Structural Steel Theory & Design

**Credit points: 6.25**

**Coordinator:** Assoc Prof Nelson Lam

**Prerequisites:** 421-317 Structural Engineering 2.

**Contact:** Five hours of lectures, three hours of tutorials and 16 hours of supervised sessions *(Semester 1).*

**Description:** The major objective of this unit is to develop an understanding of the procedures and processes involved in the design of steel structures.

Topics covered include theory behind brittle fracture and fatigue of steel structures, design of steel connections; and a major design project involving a steel structure.

**Assessment:** A 2-hour examination (50%), and a design project of approximately 10000 words (50%). Students must pass both the examination and the design project to pass this subject.

### 421-411 Concrete Theory & Design

**Credit points: 6.25**

**Coordinator:** Dr H Goldsworthy

**Prerequisites:** 421-307 Structural Engineering 1.

**Contact:** Twelve hours of lectures, 3 hours of tutorials, 1 hour practical and 8 hours of supervised design sessions *(Semester 2).*

**Description:** At the conclusion of this unit students should have developed advanced skills enabling them to analyse and design reinforced and prestressed concrete structures.

Topics include idealised frame method of slab design; flat plates and slabs; punching shear; partially pre-stressed beams and slabs; and major design project.

**Assessment:** One written 2-hour end of semester examination (70%). Design project of approximately 15 pages (25%) and practical report (5%).

### 421-420 Hydraulic Engineering Design

**Credit points: 6.25**

**Coordinator:** Mr W Robertson

**Prerequisites:** 421-316 Engineering Hydraulics and Hydrology.

**Contact:** Ten hours of lectures and 14 hours of supervised design sessions and practice classes *(Semester 2).*

**Description:** On completion of this unit students should have gained an understanding of the hydraulics of water supply/treatment/disposal and applied this knowledge to the design of common hydraulic structures.

Topics covered include urban stormwater drainage systems; urban water supply, treatment and distribution systems; water supply pipeline design and surge protection; sewerage, wastewater collection and treatment; and hydraulic design of common hydraulic structures.

**Assessment:** One 2-hour written examination (50%), practice classes, design report and assignments (up to a total of 25 pages inclusive of diagrams, tables, computations and computer output) (50%).

### 421-439 Geotechnical Applications

**Credit points: 12.5**

**Coordinator:** Dr S Yuen

**Prerequisites:** 421-306 Geotechnical Engineering.

**Contact:** Thirty-two hours of lectures and 16 hours of tutorials *(Semester 2).*

**Description:** On completion of this unit students should be able to analyse for both the bearing capacity and settlement characteristics of footings subjected to a variety of loadings; apply geotechnical engineering principles to solve contaminated soils and waste disposal problems; and have an understanding of rock mass behaviour.

Topics covered include shallow footings, bearing capacity solutions, settlement on sand and clays; Skempton-Bjerrum, Lambe and Davis Poulos methods, raft foundations, compensated foundations, expansive clays, soil improvement, deep foundations; capacity and settlement of single piles and pile groups; properties of waste materials, contaminated soils, effects of chemicals on soil properties, waste disposal systems, regulations governing waste disposal and management, site assessment/site selection, remediation techniques, liners, leachate collection systems, excavation and rock mass behaviour.

**Assessment:** One 3-hour end of semester written examination (60%), together with three assignments of no more than 3000 words each due throughout the semester (40%). A pass in both assignment and examination components is required to pass the subject.

### 421-447 Transport Engineering

**Credit points: 12.5**

**Coordinator:** Dr R Thompson

**Contact:** Twenty-four hours of lectures, 12 hours of design and 12 hours of practice classes *(Semester 1).*

**Description:** At the conclusion of this subject students should have an understanding of fundamentals of traffic engineering; an appreciation of the role of engineering in the transport planning process; an awareness of processes involved in the design of road and transport networks; and an ability to perform such designs.

Topics covered include transport systems, the transport planning process, traffic survey methods, traffic flow theory, capacity of unsignalised intersections, traffic management and transport models; and traffic signal timing analysis and geometric design of roads.

**Assessment:** One 2-hour written examination (60%), 3 written assignments each with a maximum of 3000 words or equivalent (40%).

### 421-448 Transport Systems

**Credit points: 12.5**

**Coordinator:** Dr R Thompson

**Contact:** Twenty-four hours of lectures and 24 hours of practice classes *(Semester 2).*

**Description:** On completion of this unit students should have an understanding of the prediction of demand and systems available to meet this demand for both motorised and non-motorised traffic; the theory and practice of transportation planning; and an ability to apply this knowledge to design and manage transport systems.

Topics covered include traffic management, traffic simulation modelling, travel demand management, non-motorised transport, road safety, parking, environmental impacts of traffic, geographic information systems, travel surveys, travel behaviour modelling, intelligent transport systems, city logistics, and public transport system design.

**Assessment:** One 2-hour written examination (40%) two written assignments each with a maximum of 3000 words or equivalent (60%)

### 421-453 Engineering Systems Management

**Credit points: 6.25**

**Coordinator:** Dr R Thompson

**Prerequisites:** 421-255 Management for Engineers 1.

**Contact:** Twelve hours of lectures and 12 hours of practice classes *(Semester 1).*

**Description:** At the conclusion of this course students should have acquired a knowledge of the role of systems analysis techniques as aids to decision making for planning, design and management of engineering systems.

Topics covered include demand forecasting, risk analysis and management, network analysis, artificial intelligence and multi-objective decision-making techniques, simulation mdelling and dynamic programming.

**Assessment:** One 2-hour written end of semester examination (40%) and one written assignment with a maximum of 5000 words or equivalent (60%) due during semester.

## 421-456 Engineering Management 3E

**Credit points: 6.25**

**Coordinator:** Mr W Robertson

**Prerequisites:** 421-355 Management for Engineers 2.

**Contact:** Sixteen hours of lectures and eight hours of practical classes *(Semester 1).*

**Description:** At the completion of this subject, students should be able to: (i) apply management principles to the development of an environmental management system based on the ISO 1400 Standard for an environmental engineering project; (ii) appreciate the dynamics of small group interactions and teamwork in making presentations to, and in preparing reports (including a non-technical summary) for, senior management; and (iii) recognise the need for and practice of personnel skills ranging from making personal presentations, undertaking interviews and performance appraisals, providing good communication and managing human resources.

**Assessment:** A 2-hour written end of semester examination (70%) and one written assignment with a maximum of 4000 words or equivalent (30%) due during the semester.

## 421-460 Research Project (Civil)

**Credit points: 12.5**

**Coordinator:** Dr R Thompson

**Prerequisites:** A grade of H2A or above in 421-401 Techniques of Research and Investigation.

**Contact:** Forty-eight hours of laboratory/research work *(Semester 2).*

**Description:** On conclusion of their project students should have an appreciation of procedures involved in conducting research and have gained experience in technical report writing and oral presentation.

Topic chosen from a list circulated during Semester 1.

**Assessment:** Written report of up to 5000 words with no more than 20 pages of supporting material (appendices, diagrams, tables, computations and computer output) (80%) and an oral presentation of major findings before an audience of students and teaching staff (20%).

## 421-476 Environmental Engineering Design 2

**Credit points: 12.5**

**Coordinator:** Dr J Walker

**Prerequisites:** Successful completion of all core BE 300-level subjects and 421-490 Quantification of Physical Processes A and 421-491 Quantification of Physical Processes B.

**Contact:** 8-hours of lectures, 40-hours design classes *(Semester 2).*

**Description:** Students completing this unit should have an ability to carry out a substantial investigation or design of a water and/or land related problem as part of a small team.

Topics covered include investigation/design projects associated with a contemporary environmental engineering problem or opportunity.

**Assessment:** Written reports and assignments during weeks 4 and 5 up to a total of 60 pages (inclusive of diagrams, tables, computations and computer output) (80%). An oral assessment of up to 30 minutes (20%).

## 421-477 Research Project (Environmental)

**Credit points: 12.5**

**Coordinator:** Dr J.P. Walker

**Prerequisites:** Successful completion of all core BE 300-level subjects and 421-490 Quantification of Physical Processes A, 421-491 Quantification of Physical Processes B.

**Contact:** Four one-hour lectures, one 2-hour poster session, one 8-hour seminar session *(Semester 2).*

**Description:** On conclusion of their project, students should have an appreciation of procedures involved in conducting research and have gained experience in technical report writing and oral presentation.

Topics covered include guided supervision of project specification, literature review, methodology development, analysis and reporting of a theoretical or practical investigation on a topic in the area of environmental engineering.

**Assessment:** One end-of-semester research report up to a total of 60 pages (inclusive of diagrams, tables, computations and computer output) (70%); one mid semester preliminary research report of not more than 20 pages (10%) one exam period seminar presentation (15%); one mid-semester poster presentation (5%).

## 421-482 Analysis & Design-Environmental Systems

**Credit points: 12.5**

**Coordinator:** Dr R. Argent

**Prerequisites:** 421-490 Quantification of Physical Processes A, 421-491 Quantification of Physical Processes B and 421-322 Environmental Engineering Design 1.

**Contact:** Twelve hours lectures, 36 hours of design classes and 8-hours of site visits *(Semester 2).*

**Description:** At the conclusion of this subject students should be able to identify the processes in the environment that impinge on a range of practical problems they will encounter in their career. With this skill and foundation theory of physical hydrology, design and management, they will be able to develop solutions to these problems.

Typical problems may include irrigation and drainage design, hydro-geological problems such as landfill containment, catchment management, stream rehabilitation and rehabilitation of degraded land such as mine sites.

**Assessment:** Three written group reports (30% each due at end of weeks 3, 8 and 11, not exceeding 20 pages each inclusive of diagrams, tables, computations and computer output). Students must attend the site units and achieve a pass on each report in order to pass the subject.

## 421-489 Hydraulics Applications

**Credit points: 12.5**

**Coordinator:** Assoc Prof Roger Hughes

**Prerequisites:** 421-305 Engineering Hydraulics 1, 421-316 Engineering Hydraulics and Hydrology.

**Contact:** Forty-four hours of lectures and practice classes *(Semester 1).*

**Description:** The subject will be delivered by one of Australia's leading hydraulics consultants with a strong emphasis on projects in coastal engineering. A number of engineering projects will be selected for detailed analysis. This subject is specifically designed for those interested in hydraulics consultancy.

Background hydrodynamics theory including water surface-wave mechanics will be presented as required. Other topics covered in the discussion of specific projects will include: literal drift of sand along the coastline; the natural frequencies of harbour oscillations; and wave forces on structures. General background material relating to tsunamis generation, the origins of El Nino and the behaviour of the ocean in an enhanced "greenhouse" environment will also be discussed.

**Assessment:** One 3-hour end-of-semester examination (100%) but small tests and exercises will be given during the semester to indicate student progress.

## 421-490 Quantification of Physical Processes A

**Credit points: 12.5**

**Coordinator:** Dr J.P Walker

**Prerequisites:** 421-316 Engineering Hydraulics and Hydrology, 421-325 Field Data Acquisition and Analysis and 421-327 Computing for Land and Spatial Systems or equivalent

**Contact:** Thirty-two hours of lectures, 16 hours of tutorials, computer labs and practicals *(Semester 1).*

**Description:** This is a companion subject to 421-491 Quantification of Physical Processes B. At the conclusion of this subject students should be capable of undertaking quantitative analyses of physical processes related to surface hydrology. Emphasis will be placed on the application of fundamental principles of mathematics and physics to the conceptualisation and analysis of the complex interactions that are the hallmark of environmental systems. Students should also be able to build computer models of these interactions and interpret the output from such models. Topics covered include global water, energy and carbon cycles, precipitation, evapotranspiration, interaction between surface and subsurface water, runoff processes, hydrological modelling and water quality.

**Assessment:** One 3-hour end of semester examination (70%) and assignments and quizzes throughout the semester totalling less than 2000 words (30%).

## 421-491 Quantification of Physical Processes B

**Credit points: 12.5**

**Coordinator:** Dr A Western

**Prerequisites:** 421-316 Engineering Hydraulics and Hydrology, 421-325 Field Data Acquisition and Analysis and 421-327 Computing for Land and Spatial Systems or equivalent.

**Contact:** Thirty-two hours lectures, 16 hours of tutorials, computer labs and practical *(Semester 1).*

**Description:** This is a companion subject to 421-490 Quantification of Physical Processes A. At the conclusion of this subject students should be capable of undertaking quantitative analyses of physical processes related to subsurface hydrology. Emphasis will be placed on the application of fundamental principles of mathematics and physics to the conceptualisation and analysis of the complex interactions that are the hallmark of environmental systems. Students should also be able to build computer models of these interactions and interpret the output from such models. Topics covered include interaction between surface and subsurface water, the unsaturated zone, groundwater hydrology, numerical groundwater modelling, contaminant transport in groundwater, and contaminated site remediation.

**Assessment:** One 3-hour written end of semester examination (70%) and assignments and quizzes totalling less than 2000 words (30%).

### 421-495 Structural Design

**Credit points: 12.5**

**Coordinator:** Dr Emad Gad

**Prerequisites:** 421-410 Structural Steel Theory and Design.

**Contact:** Forty-eight hours of lectures and tutorials *(Semester 2).*

**Description:** On the completion of this elective unit students should appreciate the design methodology used for structures constructed of concrete, timber, masonry, cold-formed steel and composites, and be able to produce effective and economical design solutions through correct integration of these materials.

**Assessment:** A 3-hour end-of-semester examination (70%) and two assignments totalling 30%. Each assignment is no more than 3000 words, with one assignment on concrete technology and the second on design, to be undertaken throughout the semester.

### 421-496 High Rise Structures

**Credit points: 12.5**

**Coordinator:** Assoc Prof Mendis

**Prerequisites:** 421-317 Structural Engineering 2

**Contact:** Thirty-two hours of lectures and 18 hours of tutorials/supervised design session *(Semester 1).*

**Description:** The objective of this unit is to make students aware of the special requirements necessary to the successful design of high-rise structures. Topics covered include structural systems including floor systems, framing systems and foundation systems; environmental actions such as wind, earthquake and thermal; wind tunnel testing; effect of time dependent actions such as creep and shrinkage; and analytical aspects including computer-aided analysis and design, state-of-the-art construction techniques, special structural elements, case studies of high-rise buildings and towers.

**Assessment:** One 3-hour end of semester examination (70%) and one assignment of 3000 words equivalent (30%)

### 421-629 Energy Efficiency Technology

**Credit points: 12.5**

**Coordinator:** Dr L Aye

**Contact:** Twenty-four hours of lectures and 12 hours of set tasks *(Semester 1).*

**Description:** On completion students should understand the basic issues in energy efficient technologies and their implementation; the current possibilities for improving the ratio of energy used per unit of output in the main sectors of society, ie. transportation, manufacturing, commercial, domestic, energy supply industries; the economic and environmental implications for the adaption of these technologies; potential for improvements in energy efficiency in gasoline and diesel vehicle, oil refinery system; energy efficiency technologies for the manufacturing, commercial and domestic sectors; demand side management; integrated resource planning; energy auditing; and economics and environmental impacts.

**Assessment:** One 2-hour examination (50% weighting) and one assignment of up to 2000 words or equivalent (50% weighting).

### 431-201 Engineering Analysis A

See full subject details on page 11.

### 431-202 Engineering Analysis B

See full subject details on page 12.

### 433-171 Introduction to Programming

See full subject details on page 17.

### 451-201 Geomatics for Engineers

See full subject details on page 6.

### 610-141 Chemistry A

See full subject details on page 2.

### 610-142 Chemistry B

See full subject details on page 2.

### 610-280 Environmental Chemistry

See full subject details on page 5.

### 620-121 Mathematics A (Advanced)

See full subject details on page 4.

### 620-123 Applied Mathematics (Advanced)

See full subject details on page 4.

### 620-141 Mathematics A

See full subject details on page 5.

### 620-143 Applied Mathematics

See full subject details on page 5.

### 620-231 Vector Analysis

See full subject details on page 7.

### 620-232 Mathematical Methods

See full subject details on page 7.

### 625-023 Geology (Engineering Course)

See full subject details on page 5.

### 732-103 Principles of Business Law

See full subject details on page 1.