Faculty of Science

Member Units

School of Biological Sciences

Department of Chemistry

School of Earth and Environmental Sciences

Courses Offered

Doctor of Philosophy

Biological Sciences
Chemistry
Environmental Science
Geography
Geology
Physics*

Master of Science – Research

Biological Sciences
Biotechnology
Chemistry
Geography
Geology
Medicinal Chemistry
Physics*

Master of Environmental Science – Research

Master of Environmental Science Advanced

Master of Arts (Geography)

Master of Science

Biotechnology
Environmental Biology
Chemistry
Medicinal Chemistry
Medical Radiation Physics*
Geography or Geology

Master of Environmental Science

Graduate Diploma in Science

Biological Sciences
Chemistry
Geography
Geology
Physics*

*Refer to the Faculty of Engineering

For tuition fee information please see the following:
Domestic - www.uow.edu.au/student/finances/studentcontributions.html
International - www.uow.edu.au/prospective/international/fees/

Doctor of Philosophy

Testamur Title of Degree:	Doctor of Philosophy
Abbreviation:	PhD
Home Faculty:	Science
Duration:	3 years or part-time equivalent
Total Credit Points:	48 cps per year
Starting Session(s):	Autumn or Spring
Location:	Wollongong
UOW Course Code:	201
CRICOS Code:	001243F (Lab), 020192K (non-Lab)

Overview

Candidates complete a major thesis and undertake a research project arranged in consultation with an appropriate member of staff, and approved by the Head of Department or School, before enrolment. Doctoral theses must make a major original contribution to scientific knowledge in the chosen area of research.

Entry Requirements / Assumed Knowledge

Honours degree of at least four years duration in a relevant discipline at Class II, Division 2, or higher (or equivalent).

Course Requirements

Candidates complete a Doctoral dissertation of approximately 60,000 – 80,000 words in length.
Students enrol in the appropriate major thesis subject.

Disciplinary Areas Available

Biological Sciences
Chemistry
Environmental Science
Geography
Geology
Physics*

**Refer to Faculty of Engineering*

Other Information

For further information contact the Faculty of Science Office, 41.258, or telephone 4221 3481.
Web site: www.uow.edu.au/science/ .

Specific enquiries should be directed to the appropriate Academic Unit: School of Biological Sciences 4221 3013, Department of Chemistry 4221 3509 or School of Earth and Environmental Sciences 4221 3721.

Master of Science - Research

Testamur Title of Degree:	Master of Science - Research
Abbreviation:	MSc - Res
Home Faculty:	Science
Duration:	1.5 years or part-time equivalent
Total Credit Points:	72
Starting Session(s):	Autumn or Spring
Location:	Wollongong
UOW Course Code:	304
CRICOS Code:	042532B

Overview

Courses provide for the specific needs and interests of students wishing to obtain experience in a modern research program.

Entry Requirements / Assumed Knowledge

Minimum entry requirement is a Bachelor degree with a major study in the relevant discipline.

Course Requirements

The course consists of 72 credit points to be completed in a maximum time of two years (four sessions), as follows:

- 24 credit points of coursework; and
- 48 credit point research project.

Students entering with a degree at the level of at least a Bachelor Honours Class II, Division 2 may be awarded the 24 credit points of coursework as advanced standing based on prior research training.

Students undertaking the 24 credit points of coursework will select appropriate postgraduate subjects from those offered in the discipline in consultation with the Head of Department or School or the Postgraduate Coordinator.

For detailed possible coursework subject programs consult the Master of Science by coursework degree in the relevant discipline.

Disciplinary Areas Available

Biological Sciences
Biotechnology
Chemistry
Geography
Geology
Medicinal Chemistry
Physics*

**Refer to Faculty of Engineering*

Other Information

For further information contact the Faculty of Science Office, 41.258, or telephone 4221 3481.
Web site: www.uow.edu.au/science/

Specific enquiries should be directed to the appropriate Academic Unit: School of Biological Sciences 4221 3013, Department of Chemistry 4221 3509 or School of Earth and Environmental Sciences 4221 3721.

Master of Environmental Science - Research

Testamur Title of Degree:	Master of Environmental Science - Research
Abbreviation:	MEnvSc - Res
Home Faculty:	Science
Duration:	1-2 years depending on entry qualifications
Total Credit Points:	72
Delivery Mode:	Flexible and face-to-face
Starting Session(s):	Autumn and Spring
Location:	Wollongong
UOW Course Code:	1312
CRICOS Code:	042533A

Overview

This program involves a major project in one of the many research areas of environmental science available in the Faculty. The research project will provide information for improved understanding of how ecosystems work, for solving environmental problems of immediate concern and to assist policy makers in developing new strategies and legislation for environmental management. This degree provides the opportunity for students to contribute to this work by undertaking a major research project in one of the areas of environmental science within the Faculty.

Entry Requirements / Assumed Knowledge

A degree with Honours in environmental science, science or engineering at a level of at least Class II, Division 2, or a Master of Environmental Science or Master of Science with credit average, or equivalent qualifications or appropriate publications and work experience.

Entry must be approved by the Coordinator and, if thesis work is being supervised by staff from an Academic Unit, the Head of that Unit.

Course Requirements

The course consists of 72 credit points to be completed in a maximum time of 2 years (4 sessions), as follows:

1. a 48 credit point research project (THES924 Thesis);
2. a maximum of 24 credit points of subjects, chosen from the Environmental Science postgraduate schedule in consultation with the Coordinator of Environmental Science.

Special Note: Students entering with an Honours degree at the level of at least Bachelor Honours Class II, Division 2, or a Master of Environmental Science degree (or equivalent) will normally be awarded advanced standing for the 24 credit points of coursework, except for candidates with no background in environmental science who will be required to complete ENVI920 Scientific Basis of Environmental Management (8 cps).

Course Program

Subjects		Session	Credit Points
THES924	Thesis		48
Plus a maximum of 24 credit points of subjects chosen from those listed below in consultation with the Coordinator of Environmental Science			
ENVI921	Environmental Planning	Autumn	8
ENVI920	The Scientific Basis of Environmental Management	Spring	8
ENVI910	Directed Studies in Pollution Chemistry	Annual, Spring or Autumn	12
ENVI911	Directed Studies in Ecology	Annual, Spring or Autumn	12
ENVI912	Directed Studies in Land Resources	Annual, Spring or Autumn	12
ENVI913	Directed Studies in Earth Sciences	Annual, Spring or Autumn	12
ENVI919	Directed Studies in Environmental Science	Annual, Spring or Autumn	12
EESC902	Advanced Coastal Environments	Spring	12
EESC903	Advanced Fluvial Geomorphology & Sedimentology	Autumn	12
EESC904	Advanced Geographic Information Systems	Spring	12
EESC912	Advanced Soils, Landscape and Hydrology	Spring	12
EESC905	Advanced Remote Sensing	Spring	12
EESC951	Advanced Topic B	Autumn, Spring or Annual	8
ENVE985	Environmental Engineering	Autumn	8

Other Information

For further information contact the Faculty of Science Office, 41.258, or telephone 4221 3481.
Or the Environmental Science Unit, 19.G012, 4221 4134.
Web site: http://www.uow.edu.au/science/eesc/student/envsci.html.

The Degree Coordinator is Professor John Morrison, Environmental Science Unit, School of Earth and Environmental Sciences, Room 19.G012.

Master of Environmental Science - Advanced

Testamur Title of Degree:	Master of Environmental Science - Advanced
Abbreviation:	MEnvSc Adv
Home Faculty:	Science
Duration:	2 years or part-time equivalent
Total Credit Points:	96
Delivery Mode:	Face-to-face
Starting Session(s):	Autumn and Spring
Location:	Wollongong
UOW Course Code:	412
CRICOS Code:	048589C

Overview

This degree is aimed primarily at international students, and combines research and coursework to provide a two-year (or part-time equivalent) degree for Science and Engineering graduates or others, with a limited undergraduate background in the environmental science area.

Entry Requirements / Assumed Knowledge

Bachelor degree in Environmental Science, Science, Applied Science, Agriculture, Forestry, Veterinary Science or Engineering, or equivalent tertiary qualifications and/or professional experience. Students must consult with the Coordinator of Environmental Science for approval of overall entry.

Course Requirements

Candidates must complete the three core subjects plus a Research Report of either 24 or 32 credit points plus elective subjects to total 96 credit points, as set out below.

Course Program

Subjects		Session	Credit Points
ENVI920	The Scientific Basis of Environmental Management	Spring	8
ENVI921	Environmental Planning	Autumn	8
STS929	Studies in Resource and Environmental Policy	Autumn	8
Plus one of the following:			
ENVI930	Research Report	Annual, Autumn or Spring	24
ENVI931	Research Report	Annual, Autumn or Spring	32
Plus two or three of the following:			
LAW9380	Law for Environmental Managers	Spring	8
ENVE985	Environmental Engineering	Autumn	8
STS300	The Environmental Context	Autumn	8
Plus at least two of the following:			
ENVI910	Directed Studies in Pollution Chemistry	Annual, Autumn or Spring	12
ENVI911	Directed Studies in Ecology	Annual, Autumn or Spring	12
ENVI912	Directed Studies in Land Resources	Annual, Autumn or Spring	12
ENVI913	Directed Studies in Earth Sciences	Annual, Autumn or Spring	12

Other Information

For further information contact the Faculty of Science Office, 41.258, or telephone 4221 3481, email trina@uow.edu.au or the Environmental Science Unit, 19.G012, 4221 4134.
Web site: http://www.uow.edu.au/science/eesc/student/envsci.html.

The Degree Coordinator is Professor John Morrison, Environmental Science Unit, School of Earth and Environmental Sciences, Room 19.G012.

Master of Arts (Geography)

Testamur Title of Degree:	Master of Arts (Geography)
Abbreviation:	MA
Home Faculty:	Science
Duration:	1 year or part-time equivalent
Total Credit Points:	48
Delivery Mode:	Face-to-face
Starting Session(s):	Autumn or Spring
Location:	Wollongong
UOW Course Code:	571
CRICOS Code:	042535K

Overview

This coursework degree is designed for candidates who wish to extend their grounding in Geography beyond the undergraduate level. It also provides an alternative route to subsequent PhD studies for students who do not possess a BA (Honours) degree.

Entry Requirements / Assumed Knowledge

Normally a pass Bachelors degree of at least 3 years duration in a relevant discipline (with at least three third year level subjects in the discipline) or a similar tertiary qualification, with relevant work experience, as approved by the Head of School.

Course Requirements

Candidates must complete 48 credit points of 900-level subjects, as set out below, as approved by the Course Coordinator. Students may be required to complete additional credit points if their disciplinary background is deemed not satisfactory.

Geography

Course Information

The following coursework subjects have been devised by the School of Earth and Environmental Sciences to meet the needs of students who wish to proceed to the postgraduate level in Geography to enhance their qualifications in an area without undertaking a research project.

The subjects have been grouped in two strands which reflect the major research strengths in Geography within the School of Earth and Environmental Sciences.

- Physical Geography and Environments
- Human Geography and Environments

Students with a satisfactory background in Earth and Environmental Sciences complete subjects to the value of 48 credit points chosen from either of the two programs, in consultation with the Course Coordinator. Other students may be required to complete subjects to a value of 72 credit points.

Subjects		Session	Credit Points
Physical Geography and Environments			
EESC901	Advanced Plate Tectonics, Macrotopography and Earth History	Autumn	12
EESC902	Advanced Coastal Environments: Processes and Management	Spring	12
EESC903	Advanced Fluvial Geomorphology and Sedimentology	Autumn	12
EESC904	Advanced Geographic Information Science	Spring	12
EESC905	Advanced Remote Sensing	Autumn	12
EESC912	Advanced Soils, Landscape and Hydrology	Spring	12
EESC950	Advanced Topic A	Autumn/Spring/Annual	12
EESC951	Advanced Topic B	Autumn/Spring/Annual	8
Human Geography and Environments			
EESC904	Advanced Geographic Information Science	Spring	12
EESC905	Advanced Remote Sensing	Autumn	12
EESC910	Advanced Social Spaces: Rural and Urban	Spring	12
EESC917	Advanced Spaces, Places and Identities	Autumn	12
EESC918	Advanced Environmental and Heritage Management	Spring	12
EESC950	Advanced Topic A	Autumn/Spring/Annual	12
EESC951	Advanced Topic B	Autumn/Spring/Annual	8

Other Information

For further information contact the Faculty of Science Office, 41.258, or telephone 4221 3481.
Web site: www.uow.edu.au/science/ .

Specific enquiries should be directed to the School of Earth and Environmental Sciences 4221 3721.

Master of Science

Testamur Title of Degree:	Master of Science (specialisation)
Abbreviation:	MSc
Home Faculty:	Science
Duration:	1 year or part-time equivalent
Total Credit Points:	48
Delivery Mode:	Face-to-face
Starting Session(s):	Autumn or Spring
Location:	Wollongong
UOW Course Code:	574
CRICOS Code:	048498F

Overview

This coursework degree is designed for candidates who wish to extend their grounding in a particular science discipline beyond the undergraduate level. It also provides an alternative route to subsequent PhD studies for students who do not possess a BSc (Honours) degree.

Specialisations available are:

- Biotechnology
- Environmental Biology

- Chemistry
- Medicinal Chemistry
- Medical Radiation Physics (refer to the Faculty of Engineering)
- Geography
- Geology

Entry Requirements / Assumed Knowledge

Normally a pass Bachelors degree of at least 3 years duration in the relevant discipline (with at least three third year level subjects in the discipline) or a similar tertiary qualification, with relevant work experience, as approved by the relevant Masters Coordinator or Head of Department or School.

Additional specific entry requirements for Biotechnology:
A relevant undergraduate degree of at least four years duration, or a similar tertiary qualification with relevant work experience. The degree must have included components dealing with one or more of the following areas: biology, biochemistry, cell biology, molecular biology, or microbiology. In addition, the student must have completed the equivalent of at least one year of academic study in chemistry.

Course Requirements

Candidates must complete 48 credit points of 900-level subjects as determined for the disciplinary specialisation, as set out below, and approved by the Course Coordinator. Students may be required to complete additional credit points if their disciplinary background is deemed not satisfactory.

Areas of Specialisation

Biotechnology

The Master of Science (Biotechnology) is designed for graduates who seek knowledge and technological expertise in specific areas of cell and molecular biology, which are the basis for modern biotechnological research and development. Students complete 48 credit points of subjects as listed below chosen in consultation with the Biotechnology Masters Coordinator.

Note: Spring Session start is not advised unless the student has a very strong academic background.

Subjects		Session	Credit Points
BIOL980	Biotechnology	Autumn	12
BIOL981	Molecular Cell Biology	Autumn	12
BIOL982	Infection and Immunity	Spring	12
BIOL984	Applied Bioinformatics	Spring	12
Optional Subjects			
One of the following subjects may be substituted for one of the core subjects after consultation with the Biotechnology Masters Coordinator.			
BIOL972	Ecological and Evolutionary Physiology	Autumn	12
BIOL983	Research Methods in Biotechnology	Autumn	12
BIOL992	Literature Review	Autumn/ Spring/ Summer	12
BIOL993	Research Project	Autumn/ Spring/ Summer	12

Environmental Biology

This coursework program is designed for students who seek further knowledge and skills in the biological sciences, or seek to qualify for a postgraduate research degree. Students complete coursework to a value of 48 credit points as listed below, chosen in consultation with the Masters Coordinator.

Note: Spring Session start is not advised unless the student has a very strong academic background.

Subjects		Session	Credit Points
BIOL970	Advances in Conservation Biology	Autumn	12
BIOL971	Marine and Terrestrial Ecology	Spring	12
BIOL972	Ecological and Evolutionary Physiology	Autumn	12
MARE973	Advanced Topics in Fisheries and Aquaculture	Spring	12
Alternative Options			
MARE957	Advanced Topics in Molluscan Biology	Summer	12
BIOL992	Literature Review	Autumn/ Spring/ Summer	12
BIOL993	Research Project	Autumn/ Spring/ Summer	12
BIOL991	Major Research Project	Autumn/ Spring/ Summer	24

Or 900- level subjects from other academic units subject to the approval of the Heads of those units and the Masters Coordinator
Note: Students cannot enrol in subjects where they have completed the equivalent 300- level subjects at this University.

Chemistry

This program is designed for applicants from industry or education who wish to extend their grounding in chemistry theory beyond the undergraduate level. It also provides an alternative route to subsequent PhD studies for students who do not possess a BSc(Honours) degree. Candidates complete 48 credit points of coursework consisting of the following four subjects.

Subjects		Session	Credit Points
CHEM910	Research Skills Training	Annual/ Autumn/ Spring	12
Plus 3 subjects selected from:			
CHEM915	Advanced Chemistry Laboratory Project	Annual/ Autumn/ Spring	12
CHEM919	Literature Report in Chemistry	Annual/ Autumn/ Spring	12
CHEM940	Contemporary Topics in Biomolecular Chemistry	Annual/ Autumn/ Spring	12
CHEM950	Contemporary Topics in Analytical and Environmental Chemistry	Annual/ Autumn/ Spring	12

Medicinal Chemistry

This coursework program provides vocational training in medicinal chemistry, an area where there is currently a high demand for graduates. The program consists of special coursework in medicinal chemistry and a small research project.

Students complete 48 credit points of coursework over one year (or equivalent part time) by enrolling in the following subjects, as approved by the Course Coordinator.

Subjects		Session	Credit Points
CHEM910	Research Skills Training	Annual/ Autumn/ Spring	12
CHEM930	Selected Topics in Medicinal Chemistry	Annual/ Autumn/ Spring	12
Plus two subjects selected from:			
CHEM915	Advanced Chemistry Laboratory Project	Annual/ Autumn/ Spring	12
CHEM919	Literature Report in Chemistry	Annual/ Autumn/ Spring	12
CHEM940	Contemporary Topics in Biomolecular Chemistry	Annual/ Autumn/ Spring	12
CHEM950	Contemporary Topics in Analytical and Environmental Chemistry	Annual/ Autumn/ Spring	12

Geography or Geology

The following coursework subjects have been devised by the School of Earth and Environmental Sciences to meet the needs of students who wish to proceed to the postgraduate level in Geography or Geology to enhance their qualifications in an area without undertaking a research project. The subjects have been grouped in three strands which reflect the major research strengths within the School of Earth and Environmental Sciences.

- Physical Geography and Environments
- Human Geography and Environments
- Geology

Students with a satisfactory background in Earth and Environmental Sciences complete subjects to the value of 48 credit points chosen from either of the two programs in consultation with the Course Coordinator. Other students may be required to complete subjects to a value of 72 credit points.

Subjects		Session	Credit Points
Physical Geography and Environments			
EESC901	Advanced Plate Tectonics, Macrotopography and Earth History	Autumn	12
EESC902	Advanced Coastal Environments: Processes and Management	Spring	12
EESC903	Advanced Fluvial Geomorphology and Sedimentology	Autumn	12
EESC904	Advanced Geographic Information Science	Spring	12
EESC905	Advanced Remote Sensing	Autumn	12
EESC912	Advanced Soils, Landscape and Hydrology	Spring	12
EESC950	Advanced Topic A	Autumn/ Spring/ Annual	12
EESC951	Advanced Topic B	Autumn/ Spring/ Annual	8
Human Geography and Environments			
EESC904	Advanced Geographic Information Science	Spring	12
EESC905	Advanced Remote Sensing	Autumn	12
EESC910	Advanced Social Spaces: Rural and Urban	Spring	12
EESC917	Advanced Spaces, Places and Identities	Autumn	12
EESC918	Advanced Environmental and Heritage Management	Spring	12
EESC950	Advanced Topic A	Autumn/ Spring/ Annual	12
EESC951	Advanced Topic B	Autumn/ Spring/ Annual	8

Subjects		Session	Credit Points
Geology			
EESC901	Advanced Plate Tectonics, Macrotopography and Earth History	Autumn	12
EESC903	Advanced Fluvial Geomorphology and Sedimentology	Autumn	12
EESC904	Advanced Geographic Information Science	Spring	12
EESC905	Advanced Remote Sensing	Autumn	12
EESC911	Isotope Geochemistry	Autumn	12
EESC921	Environmental Geology	Spring	12
EESC950	Advanced Topic A	Autumn/ Spring/ Annual	12
EESC951	Advanced Topic B	Autumn/ Spring/ Annual	8

Other Information

For further information contact the Faculty of Science Office, 41.258, or telephone 4221 3481.
Web site: www.uow.edu.au/science/ .

Specific enquiries should be directed to the appropriate Academic Unit: School of Biological Sciences 4221 3013, Department of Chemistry 4221 3509 or School of Earth and Environmental Sciences 4221 3721.

Master of Environmental Science

Testamur Title of Degree:	Master of Environmental Science
Abbreviation:	MEnvSc
Home Faculty:	Science
Duration:	1 year or part-time equivalent
Total Credit Points:	48
Delivery Mode:	Face-to-face
Starting Session(s):	Autumn and Spring
Location:	Wollongong
UOW Course Code:	1500
CRICOS Code:	026171M

Overview

This program is designed for applicants who wish to extend their knowledge of science relating to the environment, by studying areas not covered in their undergraduate Science or Engineering degree (including environmental policy, planning and management).

Entry Requirements / Assumed Knowledge

Completion of a recognised Bachelor Degree, either: Environmental Science; Science; Applied Science; Agriculture; Forestry; Veterinary Science or Engineering (or equivalent qualifications and/or professional experience).

Alternative Entry Criteria: The person would be required to have been working in a position for at least five years which, if they left, would be filled by an appropriately qualified graduate. Normally a written statement from a suitably qualified person, usually a senior manager with a strong science background, is required as confirmation of the necessary skills.

Course Requirements

Students will undertake a program of at least 48 credit points, comprising two compulsory subjects, and optional subjects selected from the subjects listed below and approved by the Coordinator of the degree.

Course Program

Subjects		Session	Credit Points
ENVI920	The Scientific Basis of Environmental Management	Spring	8
ENVI921	Environmental Planning	Autumn	8
Plus at least 32 credit points chosen from:			
STS929	Studies in Resource and Environmental Policy	Autumn	8
ENVI910	Directed Studies in Environmental Chemistry	Annual/ Spring/ Autumn	12
ENVI911	Directed Studies in Ecology	Annual/ Spring/ Autumn	12
ENVI912	Directed Studies in Land Resources	Annual/ Spring/ Autumn	12
ENVI913	Directed Studies in Earth Sciences	Annual/ Spring/ Autumn	12
ENVI919	Directed Studies in Environmental Science	Annual/ Spring/ Autumn	12
EESC902	Advanced Coastal Environments	Spring	12
EESC903	Advanced Fluvial Geomorphology & Sedimentology	Autumn	12

Subjects		Session	Credit Points
EESC904	Advanced Geographic Information Systems	Spring	12
EESC905	Advanced Remote Sensing	Spring	12
EESC912	Advanced Soils, Landscape and Hydrology	Spring	12
EESC951	Advanced Topic B	Autumn/ Spring/ Annual	8
LAW9380	Law for Environmental Managers	Spring	8
ENVE985	Environmental Engineering	Autumn	8

Other Information

For further information contact the Faculty of Science Office, 41.258, or telephone 4221 3481, or the Environmental Science Unit, 19.G012, 4221 4134. Web site: www.uow.edu.au/science/eesc/student/envsci.html .

The Degree Coordinator is Professor John Morrison, Environmental Science Unit, School of Earth and Environmental Sciences, Room 19.G012.

Graduate Diploma in Science

Testamur Title of Degree:	Graduate Diploma in Science (specialisation)
Abbreviation:	GDipSc
Home Faculty:	Science
Duration:	1 year
Total Credit Points:	48
Delivery Mode:	Face-to-face
Starting Session(s):	Autumn or Spring
Location:	Wollongong
UOW Course Code:	650
CRICOS Code:	007042M

Overview

The Graduate Diploma in Science provides graduates with the opportunity to acquire competence in a particular area of science at a sufficiently advanced level, to enable them to either proceed with further study or to update, broaden or intensify their knowledge and skills in the discipline.

The diploma will be found useful by international students, and by students either without a full major in a discipline at undergraduate level, or who completed their first degree some years ago.

The disciplines available are:

- Biological Sciences
- Chemistry
- Geography
- Geology
- Physics*

**Refer to the Faculty of Engineering*

Entry Requirements / Assumed Knowledge

A relevant undergraduate degree of at least three years duration, or a similar tertiary qualification with relevant work experience.

Course Requirements

Candidates select subjects to the value of 48 credit points from the Undergraduate Science Schedule of subjects, the selection to be approved the Head of the relevant Department or School, who may also specify other required subjects.

Other Information

For further information contact the Faculty of Science Office, 41.258, or telephone 4221 3481.
Web site: www.uow.edu.au/science/ .

Specific enquiries should be directed to the appropriate Academic Unit: School of Biological Sciences 4221 3013, Department of Chemistry 4221 3509 or School of Earth and Environmental Sciences 4221 3721.