THE UNIVERSITY OF NEW SOUTH WALES

HANDBOOK

1994

APPLIED

SCIENCE
Subjects, courses and any arrangements for courses including staff allocated as stated in this Handbook are an expression of intent only. The University reserves the right to discontinue or vary arrangements at any time without notice. Information has been brought up to date as at 1 November 1993, but may be amended without notice by the University Council.

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It is University policy to promote equal opportunity in education (refer to EOE Policy Statement, The University of New South Wales Calendar (Summary Volume) and Student Guide 1994).
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Subject Descriptions

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Department of Fuel Technology

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Department of Wool and Animal Science

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School of Geography

Undergraduate Study

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Graduate Programs in Rangeland Management

8025 Rangeland Management Graduate Course

5025 Rangeland Management Graduate Diploma Course

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8026 Remote Sensing Graduate Course

5026 Remote Sensing Graduate Diploma Course

Graduate Programs in Environmental Studies
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- Bioengineering Centre
- Centre for Membrane and Separation Technology
- Centre for Minerals Engineering
- Centre for Particle and Catalyst Technologies
- Centre for Petroleum Engineering Studies
- Undergraduate Study: Course Outline
- 3045 Petroleum Engineering - Full-time Course
- Undergraduate Study: Subject Descriptions
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- 5031 Petroleum Engineering Graduate Diploma Course
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- Centre for Remote Sensing and Geographic Information Systems
- Energy Research, Development and Information Centre (ERDIC)
- Food Industry Development Centre
- Key Centre for Mines
- UNSW Groundwater Centre

**Servicing Subject Descriptions**

- Anatomy
- Australian Graduate School of Management
- Banking and Finance
- Biochemistry and Molecular Genetics
- Biomedical Engineering
- Biological Science
- Chemistry
- Civil Engineering
- Community Medicine
- Computer Science and Engineering
- Economics
- Department of Economic History
- Department of Economics
- Electrical Engineering
- Health Services Management
- Industrial Relations and Organizational Behaviour
- Information, Library and Archive Studies
- Information Systems
- Landscape Architecture
- Law
- Legal Studies and Taxation
- Manufacturing Management
- Marketing
- Mathematics
- Mechanical Engineering
- Medical Education
- Microbiology and Immunology
- Physics
- Psychology
- Surveying
- Town Planning

**Conditions for the Award of Degrees**

- First Degrees
- Higher Degrees
- Doctor of Philosophy (PhD)
- Master of Applied Science (MAppSc) and Master of Environmental Studies (MEnvStudies)
- Master of Engineering (ME) and Master of Science (MSc)
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Engineering and science disciplines that are directly concerned with aspects of Australia's resources have been established in the Faculty of Applied Science. Interdisciplinary and multidisciplinary course options are available to students through the various Schools within the Faculty - Applied Bioscience, Chemical Engineering and Industrial Chemistry, Fibre Science and Technology, Geography, Materials Science and Engineering, Mines, as well as the Department of Safety Science, and the Centre for Petroleum Engineering.

Undergraduate courses available are:

- Applied Geology (including specialization in Mineral Exploration and Mining Geology, Sedimentary Basin Studies, Geophysics, Engineering Geology, Environmental Geology, Geochemistry and Hydrogeology)
- Biotechnology
- Bioprocess Engineering
- Chemical Engineering (including Fuel and Energy Engineering and Mineral Engineering)
- Food Science and Technology
- Geography (including Applied Physical Geography, Applied Economic Geography, and Human and Physical Resources)
- Industrial Chemistry (including Polymer Science)
- Materials Science and Engineering (including Ceramic Engineering, Materials Engineering, and Metallurgical Engineering)
- Mining Engineering
- Petroleum Engineering
- Textile Management
- Textile Technology (including Textile Chemistry, Textile Engineering and Textile Physics)
- Wool and Pastoral Sciences

In most schools a variety of options are available, including joint degrees in other faculties (Engineering, Science, and Law). Students should discuss their programs with appropriate staff to ensure that their chosen course of study is appropriate to their aims and aspirations.

In 1991 an independent Department of Safety Science was established in the Faculty. This department specializes in multidisciplinary postgraduate training and research in a wide range of industrial and community safety issues.

The importance of applied science to the University of New South Wales, and to the wider community, is fully recognized and is especially referred to in the University Act of Incorporation. The Faculty of Applied Science is dynamic, with changing activities and programmes to meet the rapid technological developments in the applied sciences. Many of the staff of the Faculty have achieved international recognition for their work, and there is a continuing and wide range of research programs underway. The staff are enthusiastic, and I hope that you will share their enthusiasm.

Once the academic year begins, it is essential that you participate fully in your study programme from the first day of the first year. You are also urged to play an active role in the extramural activities of the University, especially in the student societies in the Schools.

Explanatory pamphlets and brochures are issued at enrolment and these, together with the Calendar, should be consulted for further information. You should not hesitate to contact the appropriate School offices if you have questions or problems.

G.J.S. Govett
Dean
Faculty of Applied Science
Calendar of Dates

The Academic year is divided into two sessions each containing 14 weeks for teaching. There is a recess of approximately six weeks between the two sessions and there are short recesses of one week within each of the sessions.

Session 1 commences on the Monday nearest 1 March.

All Faculties (other than Medicine)

<table>
<thead>
<tr>
<th>Session 1</th>
<th>1994</th>
<th>1995</th>
</tr>
</thead>
<tbody>
<tr>
<td>(14 weeks)</td>
<td>28 February to 31 March</td>
<td>27 February to 13 April</td>
</tr>
<tr>
<td></td>
<td>11 April to 10 June</td>
<td>24 April to 9 June</td>
</tr>
<tr>
<td>Recess:</td>
<td>1 April to 10 April</td>
<td>14 April to 23 April</td>
</tr>
<tr>
<td>Study Period:</td>
<td>11 June to 16 June</td>
<td>10 June to 15 June</td>
</tr>
<tr>
<td>Examinations:</td>
<td>17 June to 5 July</td>
<td>16 June 4 July</td>
</tr>
<tr>
<td>Midyear Recess:</td>
<td>6 July to 24 July</td>
<td>5 July to 23 July</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Session 2</td>
<td>25 July to 23 September</td>
<td>24 July to 22 September</td>
</tr>
<tr>
<td>(14 weeks)</td>
<td>4 October to 4 November</td>
<td>3 October to 3 November</td>
</tr>
<tr>
<td>Recess:</td>
<td>24 September to 3 October</td>
<td>23 September to 2 October</td>
</tr>
<tr>
<td>Study Period:</td>
<td>5 November to 10 November</td>
<td>4 November to 9 November</td>
</tr>
<tr>
<td>Examinations:</td>
<td>11 November to 29 November</td>
<td>10 November to 28 November</td>
</tr>
</tbody>
</table>

Important Dates for 1994

January
M  3  New Year's Day Public Holiday
M 10  Term 1 begins - Medicine IV
M 17  Term 1 begins - Medicine V
W 26  Australia Day - Public Holiday

February
T  1  Enrolment period begins for new undergraduate students and undergraduate students repeating first year.
M  7  Re-enrolment period begins for second and later year undergraduate and graduate students enrolled in formal courses. Students should consult the Re-enrolling 1994 leaflets applicable to their courses for details.
M 14  Semester 1 begins - AGSM Graduate Management Qualification

March
M  7  Term 1 begins - Australian Graduate School of Management
F 11  Last day applications are accepted from students to enrol in Session 1 or whole year subjects.
Su 13  Term 1 ends - Medicine IV
**April**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Good Friday - Public Holiday</td>
</tr>
<tr>
<td>2</td>
<td>Easter Saturday - Public Holiday</td>
</tr>
<tr>
<td>4</td>
<td>Easter Monday - Public Holiday</td>
</tr>
<tr>
<td>7</td>
<td>Mid-session Recess begins</td>
</tr>
<tr>
<td>10</td>
<td>Publication of provisional timetable for June examinations.</td>
</tr>
<tr>
<td>15</td>
<td>Examination - AGSM Graduate Management Qualification</td>
</tr>
<tr>
<td>18</td>
<td>May Recess begins - University College, Australian Defence Force Academy</td>
</tr>
<tr>
<td>20</td>
<td>Term 2 begins - Medicine V</td>
</tr>
<tr>
<td>24</td>
<td>Term 2 begins - Medicine IV</td>
</tr>
<tr>
<td>25</td>
<td>Anzac Day - Public Holiday</td>
</tr>
<tr>
<td>30</td>
<td>May Recess begins - University College</td>
</tr>
</tbody>
</table>

**May**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Term 3 begins - Medicine IV</td>
</tr>
<tr>
<td>3</td>
<td>Term 3 begins - Medicine VI</td>
</tr>
<tr>
<td>6</td>
<td>Term 1 ends - AGSM MBA Program, all classes</td>
</tr>
<tr>
<td>9</td>
<td>Examination week begins - AGSM MBA Program, all classes</td>
</tr>
<tr>
<td>10</td>
<td>Publication of provisional timetable for June examinations.</td>
</tr>
<tr>
<td>15</td>
<td>Examination - AGSM Graduate Management Qualification</td>
</tr>
<tr>
<td>18</td>
<td>Last day for students to advise of examination clashes.</td>
</tr>
<tr>
<td>20</td>
<td>Term 2 ends - Medicine V</td>
</tr>
<tr>
<td>28</td>
<td>Term 2 begins - AGSM MBA Program, all classes</td>
</tr>
<tr>
<td>31</td>
<td>Publication of timetable for June examinations.</td>
</tr>
</tbody>
</table>

**June**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Final examination - AGSM Graduate Management Qualification</td>
</tr>
<tr>
<td>6</td>
<td>Semester 1 ends - AGSM Graduate Management Qualification</td>
</tr>
<tr>
<td>9</td>
<td>Term 3 begins - Medicine V</td>
</tr>
<tr>
<td>10</td>
<td>Session 1 ends</td>
</tr>
<tr>
<td>11</td>
<td>Semester 1 ends - AGSM Graduate Management Qualification</td>
</tr>
<tr>
<td>12</td>
<td>Study recess begins</td>
</tr>
<tr>
<td>13</td>
<td>College of Fine Arts assessment week begins</td>
</tr>
<tr>
<td>14</td>
<td>Term 3 ends - Medicine VI</td>
</tr>
<tr>
<td>15</td>
<td>Term 3 ends - Medicine VI</td>
</tr>
<tr>
<td>16</td>
<td>Queen's Birthday Public Holiday</td>
</tr>
<tr>
<td>17</td>
<td>Study Recess ends</td>
</tr>
<tr>
<td>18</td>
<td>Examinations begin</td>
</tr>
<tr>
<td>19</td>
<td>Session 1 ends - University College, Australian Defence Force Academy</td>
</tr>
<tr>
<td>20</td>
<td>College of Fine Arts assessment week ends</td>
</tr>
<tr>
<td>21</td>
<td>Mid-year Recess begins - University College, Australian Defence Force Academy</td>
</tr>
<tr>
<td>22</td>
<td>Examinations begin - University College, Australian Defence Force Academy</td>
</tr>
<tr>
<td>25</td>
<td>Examinations end - University College</td>
</tr>
</tbody>
</table>

**July**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Examinations end - University College</td>
</tr>
<tr>
<td>5</td>
<td>Examinations end</td>
</tr>
<tr>
<td>6</td>
<td>Mid-year Recess begins</td>
</tr>
<tr>
<td>11</td>
<td>Semester 2 begins - AGSM Graduate Diploma in Management</td>
</tr>
<tr>
<td>17</td>
<td>Mid-year Recess ends - University College, Australian Defence Force Academy</td>
</tr>
<tr>
<td>18</td>
<td>Semester 2 begins - AGSM Graduate Management Qualification</td>
</tr>
<tr>
<td>24</td>
<td>Mid-year Recess ends</td>
</tr>
</tbody>
</table>

**August**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>3</td>
<td>Term 2 begins - Medicine IV</td>
</tr>
<tr>
<td>5</td>
<td>Term 2 ends - AGSM MBA Program, all classes</td>
</tr>
<tr>
<td>7</td>
<td>Mid-session Recess begins</td>
</tr>
<tr>
<td>8</td>
<td>Exam week begins - AGSM MBA Program, all classes</td>
</tr>
<tr>
<td>15</td>
<td>Term 5 begins - Medicine IV</td>
</tr>
<tr>
<td>20</td>
<td>Term 5 begins - Medicine VI</td>
</tr>
<tr>
<td>29</td>
<td>Term 3 begins - AGSM MBA Program, all classes</td>
</tr>
<tr>
<td>31</td>
<td>HECS Census Date for Session 2</td>
</tr>
</tbody>
</table>

**September**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>24</td>
<td>Mid-session Recess begins</td>
</tr>
<tr>
<td>25</td>
<td>Term 5 ends - Medicine IV</td>
</tr>
<tr>
<td>26</td>
<td>Term 5 ends - Medicine VI</td>
</tr>
<tr>
<td>29</td>
<td>Term 6 begins - Medicine IV</td>
</tr>
<tr>
<td>30</td>
<td>Closing date for applications to the Universities Admission Centre.</td>
</tr>
<tr>
<td>31</td>
<td>HECS Census Date for Session 2</td>
</tr>
</tbody>
</table>

**October**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Labour Day Public Holiday</td>
</tr>
<tr>
<td>4</td>
<td>Mid-session Recess ends</td>
</tr>
<tr>
<td>12</td>
<td>Last day for students to advise of examination clashes.</td>
</tr>
<tr>
<td>15</td>
<td>Examination - AGSM Graduate Diploma in Management</td>
</tr>
<tr>
<td>16</td>
<td>Term 4 ends - Medicine V</td>
</tr>
<tr>
<td>21</td>
<td>Session 2 ends - University College, Australian Defence Force Academy</td>
</tr>
<tr>
<td>24</td>
<td>Examinations begin - University College, Australian Defence Force Academy</td>
</tr>
<tr>
<td>25</td>
<td>Mid-year Recess begins - University College, Australian Defence Force Academy</td>
</tr>
</tbody>
</table>

**November**

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<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>4</td>
<td>Session 2 ends</td>
</tr>
<tr>
<td>5</td>
<td>College of Fine Arts assessment week begins</td>
</tr>
<tr>
<td>6</td>
<td>Final examination - AGSM Graduate Management Qualification</td>
</tr>
<tr>
<td>7</td>
<td>Semester 2 begins - AGSM Graduate Management Qualification</td>
</tr>
<tr>
<td>10</td>
<td>Term 6 begins - Medicine VI</td>
</tr>
<tr>
<td>11</td>
<td>Examinations begin</td>
</tr>
<tr>
<td>16</td>
<td>Mid-year Recess begins - University College, Australian Defence Force Academy</td>
</tr>
<tr>
<td>17</td>
<td>Examinations end - University College</td>
</tr>
<tr>
<td>20</td>
<td>Examinations end - University College</td>
</tr>
<tr>
<td>24</td>
<td>Term 6 ends Medicine - IV</td>
</tr>
<tr>
<td>25</td>
<td>Term 6 ends Medicine - VI</td>
</tr>
<tr>
<td>29</td>
<td>Examinations end - University College, Australian Defence Force Academy</td>
</tr>
</tbody>
</table>

**December**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Last day for acceptance of applications by the Admissions Section for transfer to another undergraduate course within the University.</td>
</tr>
<tr>
<td>26</td>
<td>Christmas Day Holiday</td>
</tr>
<tr>
<td>27</td>
<td>Boxing Day Holiday</td>
</tr>
</tbody>
</table>
Comprises Schools of Applied Bioscience, Chemical Engineering and Industrial Chemistry, Fibre Science and Technology, Geography, Materials Science and Engineering, Mines, Department of Safety Science, and the Centre for Petroleum Engineering Studies; as well as Centres located within Schools- Bioengineering, Membrane and Separation Technology, Minerals Engineering, Particle and Catalyst Technologies and the Key Centre for Mines. The Faculty is also associated with the UNSW Groundwater Centre and Centre for Remote Sensing and Geographic Information Systems.

Dean
Professor G.J.S. Govett

Presiding Member
Associate Professor J.P. Kennedy

Executive Officer
John David Collins, BSc PhD UNSW, CText, ATI

Senior Administrative Officer
Graham John Baldwin, BA A.N.U.

Project Manager
Otto Zubzanda, Dipling T.U. Bratislava, PhD UNSW

Officer-in-charge, Drawing Office
Narendra Mohan SahaChaudhury, BME Jadavpur, MIAust

Administrative Assistant
Wendy Margaret Wartho

Electron Microscope Unit
Physical Sciences Electron Microscopist
Paul Richard Munroe, BSc PhD Birm.

School of Applied Bioscience
Professor of Biotechnology, Head of School and Head of Department of Biotechnology
Peter Philip Gray, BSc Syd., PhD UNSW, FIEAust, MABA

Professor of Food Science and Technology and Head of Department of Food Science and Technology
Geoffrey Moor Wilson, BSc PhD Liv., AAIFScT

Department of Biotechnology
Head of Department of Biotechnology
Professor P. P. Gray

Professors
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Noel William Dunn, MSc Melb., PhD Monash
*John Shine, BSc PhD A.N.U.

*Conjoint appointment with The Garvan Institute of Medical Research.
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Pauline Mavis Doran, BE Qld., MSc PhD CalTech., MChemE
John Colin Madgwick, MSc PhD UNSW

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Stephen Michael Mahler, BSc Syd., PhD Qld.
Christopher Peter Marquis, BSc BE Syd.

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Malcolm Hilary Noble, BSc Macq.
John Alton Ide, BSc PhD UNSW
Rose Ann Varga, BSc UNSW
Jeffrey Harold Welch, BSc UNSW

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Robin Lee

Visiting Professor
Wayne Lyle Gerlach, BSc PhD Adel.

Visiting Fellows
Nigel Morrison, BSc Qld., PhD ANU
Peter Robert Schofield, BScAgr Syd., PhD ANU

Bioengineering Centre

Director
Professor P.P. Gray

Deputy Director
Professor J. Shine

Visiting Professor
Merilyn Sleigh, BSc Syd., PhD Macq.

Visiting Fellow
Warwick Marsden, MSc PhD UNSW

Department of Food Science and Technology

Head of Department of Food Science and Technology
Professor G. M. Wilson

Professor
Kenneth Alan Buckle, BSc PhD UNSW, FTS, FAIFST, FCIA, MIFT

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Heather Greenfield, BSc PhD Lond., FAIFST, MIBiol
Michael Wootton, BSc PhD UNSW, FAIFST, ARACI, MAGI

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MaryAnn Filadelfi-Keszi, BSc Concordia, MSc McGill, PhD Guelph, MIFT

Christopher Mo Ching Yuen, BSc DipEd W.Aust., MAppSc PhD UNSW, AAIFST

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Janet Lorraine Paterson, BSc UNSW, DipEd UNE, AAIFST
Jane Elizabeth Paton, BSc PhD UNSW, AAIFST

Associate Lecturer
Jayashree Arcot, MSc Madras, PhD Hyd., AAIFST

Administrative Officer
Richard John Greenwood, BA UNSW

Professional Officers
Maxwell Robert Bell, BSc MAppSc UNSW, ASTC
Yvone ElGhetany, BScAgr Ains Shams, MSc UNSW
Zbigniew Suminski, ME(Food Tech) Olsztyn

Honorary Visiting Fellow
Kevin Joseph Scott, BSc(Agr) Dip Ed Syd.

Research Fellow
John David Craske, MSc PhD UNSW, ASTC, FRACI, FTS, AAIFST

Food Industry Development Centre

Director
Peter Michael Cranston, MSc UNSW, PhD Macq., GradDip. UNSW and UNSW, MASM, FAIFST, ARACI

Australian Food Foundation Scientific Director
Frances Ann Warnock, BSc UNSW, GradDip(Ed) Adel.C.A.E., DipND Flin., AAIFST

Administrative Assistant
Denyse Robertson

School of Chemical Engineering and Industrial Chemistry

Professor of Chemical Technology and Head of School
David Lawrence Trimm, BSc PhD Exe., DIC Lond., CPEng, FTS, FRACI, FChemE, FIEAust

Professors of Chemical Engineering and Industrial Chemistry
Anthony Gordon Fane, BSc PhD DIC Lond., CPEng, FChemE, FIEAust
Christopher Joseph Dalzell Fell, BSc UNSW, PhD Camb., CPEng, FTS, FChemE, FIEAust, AICLE
Maria Skyllas-Kazacos, BSc PhD UNSW, ARACI, MES
Mark Sebastian Wainwright, MAppSc Adel., PhD McM., FRACI, FIEAust, CPEng, FTS

Associate Professors
Michael Paul Brungs, BSc PhD UNSW FSGT
Robert Paul Burford, BSc PhD Adel., FPRI(Aust), FRACI
Neil Russell Foster, BSc PhD UNSW, FARACI, AICLE, ACS
Judy Agnes Râper, BE PhD UNSW, CPEng, MIChemE 
Geoffrey David Sergeant, BSc PhD Wales, CEng, FAIE, 
FIE Aust, CPEng 
Robert Marsden Wood, BSc Leeds, PhD Camb., CEng, 
FIChemE

Senior Lecturers
Raj Chhabra, BSc Meerut, BE Roor., ME I.I.Sc., Bangalore, 
PhD Monash 
Rodney Phillip Chaplin, BSc PhD Adel., CChem, MACS, 
MRACI 
Phillip Thomas Crisp, BSc PhD Syd., ARACI 
Douglas Christopher Dixon, BE MEngSc Syd., PhD UNSW, 
MIE Aust 
John Clifford Jones, BSc PhD Leeds, ARACI, CChem 
Tuan Quang Pham, BE PhD Cant., MIChemE, AAIISP 
Heinz Adolf Preisig, BSc H.T.L., MSc PhD Arkansas 
John Frank Stubington, BE Qld., PhD Camb., CEng, FAIE, 
MIChemE 
T. Tran

Lecturers
Adesoji Adediran Adesina, BSc Lagos, MASc PhD Waterloo 
Rose Amal, BE PhD UNSW, MIChemE 
Henry Edward CurryHyde, BSc Natal, PhD UNSW 
Thomas Paul Davis, BSc PhD Salford, CChem, MRSC 
Dianne Elizabeth Wiley, BAAppSc DDIAE DipEd Arm. 
C.A.E., PhD UNSW, ARACI

Associate Lecturer
Anthony John Papagelis, BE UNSW

Administrative Officer
Lesley Anne Woodcock

Professional Officers
Robert Edmund Brand, BSc BE UNSW, ASTC, ARACI 
Stephen Joseph Clough, BSc Syd., MAAppSc UNSW, 
CChem, ARACI, AIE 
Van Bong Dang, BSc MAAppSc Gunma, MSc UNSW, AIE 
Barry William Edenborough, BE PhD UNSW 
Katia Simeonova Nasev, BE Higher Inst. Chem. Tech., 
Soﬁa, Grad IE Aust 
John McEwan Starling, BE UNSW

Computer Systems Ofﬁcer 
Ross James Smith, BSc PhD UNSW

Department of Chemical Engineering

Head
Professor A. G. Fane

Department of Fuel Technology

Head
Associate Professor G. D. Sergeant

Department of Industrial Chemistry

Head
Associate Professor M. P. Brungs

Department of Polymer Science

Head
Associate Professor R. P. Burford

Centre for Membrane and Separation Technology

(in association with the Faculty of Science)

Director, Chemical Engineering
Professor A. G. Fane

Director, Biophysics
Professor H. G. Coster

Centre for Particle and Catalyst Technologies

Director
Associate Professor J. A. Raper

School of Fibre Science and Technology

Professor of Wool Technology and Head of School
R. E. Griffith, BSc UNSW, PhD Leeds, CText, FTI

Project Scientist
Baden Singh Deol, MSc Panj., PhD Syd.

Administrative Ofﬁcer 
Frances Colville

Department of Textile Technology

Head of Department
Professor R. E. Griffith

Professor of Textile Physics
Ronald Postle, BSc UNSW, PhD Leeds, CText, FTI, FAIP, 
Hon. Docteur, Haute Alsace
**Associate Professor**  
Michael Thomas Pailthorpe, BSc PhD UNSW, CText, FTI, MSDC(ANZ)

**Senior Lecturers**  
John limar Curiskis, BSc PhD UNSW

**Lecturers**  
Shantha Kumari David, MSc Walk., PhD Br.Col  
Xungai Wang, BE NITSTXian, PhD UNSW

**Senior Project Scientist**  
Rup Chand Dhingra, BSc Punj., MTech I.I.T.Delhi, PhD UNSW, CText, FTI

**Professional Officers**  
Jindrich Vavrinec Brancik, MSc Brno, PhD UNSW, MACS, FRSC  
Alvin Siu Wah Li, MSc Leeds, PhD UNSW, CText, ATI  
Michael David Young, BSc PhD UNSW, CText, ATI

**Post Doctoral Fellows**  
Peter Douglas Auer, BSc PhD UNSW  
Jorge Enrique Garcia, BSc PhD UNSW, RACI

---

**Department of Wool and Animal Science**

**Associate Professor and Head of Department**  
John Patrick Kennedy, MSc UNSW, BSc Oxf., FAIAS

**Associate Professors**  
John William James, BA Qld., DSc UNSW

**Senior Lecturers**  
David John Cottle, BSc UNSW, PhD N.E.  
*Stephen James Filan, BAgEc N.E., MSc UNSW, MAIAS  
Douglas McPherson Murray, BAgSc PhD Melb., MRurSc N.E.  
Geoffrey Edward Robards, BSc UNSW, PhD Melb.

**Lecturer**  
Gordon Whitfield King, BSc PhD UNSW, DipFinMgt N.E., MAIAS, AASA, CPA

**Professional Officers**  
David John Petrie, BSc UNSW  
Eammon William Purcell, BRurSc N.E.

**Project Officer**  
Jeffrey Eppleston, MScAg Syd, PhD UNSW  
*Conjoint appointment with the School of Geography

---

**School of Geography**

**Associate Professor and Head of School**  
John Richard Dodson, MSc Monash, PhD A.N.U.

**Professor of Geography**  
Barry Jardine Garner, BA Nott., MA PhD Northwestern

---

**School of Materials Science and Engineering**

**Professor and Head of School**  
David John Young, BSc PhD Melb., FRACI, FIE Aust, CPEng, MAmerlChE

**Associate Professor**  
Charles Christopher Sorrell, BS Missouri, MS Penn., PhD UNSW, FGAA, NICE

**Senior Lecturers**  
Sri Bandypadhyay, BTech MTech I.I.T. PhD Monash, FIE Aust, CPEng MRAChE  
Alan Gordon Gershon, BSc PhD UNSW.  
Peter Krauklis, BSc PhD UNSW, MIE Aust, MIM, CEng, CPEng  
Oleg Ostrovski, Dipl.Ing.(Met.) PhD DSc (MISA, Moscow)  
Sviatoslav Antonovich Prokopovich, MSc UNSW, ASTC, CPEng, MIE Aust

**Lecturers**  
Brian Gieseson, MSc Uni. of Western Ontario, PhD UCLA  
Alan Keith Hellier, MA Camb., PhD UNSW, AMIN, AMIMechE, MAusIMM, MIE Aust, CPEng  
Patrick Wong, BE PhD UNSW, MAutoIMM  
Aibing Yu, BSc (Eng) MSc(Eng) NEUT China, PhD W'gong

**Honorary Visiting Professor**  
Max Hatherly, MSc PhD UNSW, ASTC, CPEng, FTI, FIM
Professional Officers
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Administrative Assistant
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School of Mines

Associate Professor and Head of School
Geoffrey Robert Taylor, MSc Birm., PhD N.E., FGS, MIMM, MAusIMM

Visiting Professors
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Professors of Geology
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Associate Professors
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Honorary Visiting Fellow
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Professional Officer
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Deputy Director and Senior Lecturer
Anthony Charles Partridge

Key Centre for Mines
Incorporates the University of New South Wales and the University of Wollongong

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Industry Research Officer
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Senior Research Assistant
Judith Egan, BSc LaT., MSc UNCH

Administrative Assistant
Vacant

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Monier Professor of Safety Engineering and Head of Department
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Roger Roy Hall, BSc A.N.U., MSc UNSW, FESA,
Kamal Kothiyal, MSc MTech PhD I.I.T. Delhi

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Shaharin Yussof, BEng Car.

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Barbara Littlewood

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*Edward Maxwell Nicholls, MD BS Adel., FCOM
Keith Post, BE PhD UNSW
*Conjoint appointment with the Faculty of Medicine.
**Conjoint with Faculty of Engineering.

Centre for Petroleum Engineering Studies

Director
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Professor
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Sheikh Rahman, BSc Chitt., MSc Strath., PhD Clausthal

Lecturer
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Visiting Lecturers
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Barry Walsh, BE PhD Syd.

Professional Officer
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Administrative Assistant
Jennifer Ruth Lippiatt

Centre for Remote Sensing and Geographic Information Systems

In association with the Faculty of Engineering.

Director
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Deputy Director
Ewan Gerald Masters, BSurv PhD UNSW, MISAust

UNSW Groundwater Centre

In association with the Faculty of Engineering.

Director
Richard Ian Acworth, BSc Leeds, MSc PhD Birm., FGS

Senior Lecturer
J. Jankowski
This handbook is divided into separate sections for each School/Unit, identified by a four-letter code (e.g. GEOG, School of Geography). This code appears on the top right corner of each page relating to the School/Unit. Each School/Unit section is divided into Undergraduate and Graduate Study and includes course outlines and subject descriptions.

Read the opening sections of the handbook first, and then read the information contained under Course Outlines (Undergraduate or Graduate as appropriate) within the School/Unit you are interested in. These sections cover all degrees and diplomas offered by the Faculty. Detailed information on each subject then appears under Subject Descriptions, which includes session/s offered, pre/corequisite details, class hours, credit/unit value, etc.

Any subject which is not an Applied Science subject (i.e. a subject offered by another Faculty, but included in a course), appears under the Servicing Subject Descriptions section.

As changes may be made to information provided in this Handbook, students should frequently consult the noticeboards of the schools and the official noticeboards of the University.

Undergraduate Study

It is most important that you read the opening sections of the Handbook for general information on the Faculty of Applied Science, Faculty Information, and Undergraduate Study, Course Outlines. Both of these contain specific information relating to undergraduate degrees, including Enrolment Procedures, Conditions for the Award of Degrees, Honours, Course Transfers and a number of other details that you should be familiar with.

Once you have determined which course you want to do, you must read the course outlines and then the subject descriptions for all subjects to find out what each one entails.

Graduate Study

No matter which graduate degree course you plan to undertake you must read the general summary of graduate courses in the section, Course Outlines, Graduate Study. This covers both research degrees and course work programs. Information relating to the various Masters degrees by course work and Graduate Diplomas is detailed in the appropriate School or Centre sections.

You will also need to read the Conditions for the Award of Degrees at the back of the Handbook for the formal rules governing each degree.

Most importantly, staff in the Faculty of Applied Science are only too happy to help you with any queries you might have or problems that need to be sorted out. As a first step, contact the School Office. There is a list of people who can help you at the beginning of Faculty Information. You can then be directed to other staff members who can assist you if there are very specific matters that need to be solved.
Information Key

The following key provides a guide to abbreviations used in this book:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>credit points</td>
</tr>
<tr>
<td>F</td>
<td>full year (Session 1 plus Session 2)</td>
</tr>
<tr>
<td>HPW</td>
<td>hours per week</td>
</tr>
<tr>
<td>L</td>
<td>lecture</td>
</tr>
<tr>
<td>P/T</td>
<td>Part-time</td>
</tr>
<tr>
<td>S1</td>
<td>Session 1</td>
</tr>
<tr>
<td>S2</td>
<td>Session 2</td>
</tr>
<tr>
<td>SS</td>
<td>single Session, but which Session taught is not known at time of publication</td>
</tr>
<tr>
<td>T</td>
<td>tutorial/laboratory</td>
</tr>
<tr>
<td>U</td>
<td>unit value</td>
</tr>
<tr>
<td>WKS</td>
<td>weeks of duration</td>
</tr>
<tr>
<td>X</td>
<td>external</td>
</tr>
</tbody>
</table>

Prefixes

The identifying alphabetical prefixes for each organizational unit offering subjects to students in the Faculty of Applied Science follow.

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Organizational Unit</th>
<th>Faculty/Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABIO</td>
<td>School of Applied Bioscience</td>
<td>Applied Science</td>
</tr>
<tr>
<td>ACCT</td>
<td>School of Accounting</td>
<td>Commerce &amp; Economics</td>
</tr>
<tr>
<td>ANAT</td>
<td>School of Anatomy</td>
<td>Medicine</td>
</tr>
<tr>
<td>APSE</td>
<td>Faculty of Applied Science</td>
<td></td>
</tr>
<tr>
<td>BIOC</td>
<td>School of Biochemistry</td>
<td>Biological &amp; Behavioural Sciences</td>
</tr>
<tr>
<td>BIOM</td>
<td>Centre for Biomedical Engineering</td>
<td>Engineering</td>
</tr>
<tr>
<td>BIOS</td>
<td>School of Biological Science</td>
<td>Biological &amp; Behavioural Sciences</td>
</tr>
<tr>
<td>BIOT</td>
<td>Department of Biotechnology</td>
<td>Applied Science</td>
</tr>
<tr>
<td>CEIC</td>
<td>School of Chemical Engineering &amp; Industrial Chemistry</td>
<td>Applied Science</td>
</tr>
<tr>
<td>CHEM</td>
<td>School of Chemistry</td>
<td>Science</td>
</tr>
<tr>
<td>CHEN</td>
<td>Department of Chemical Engineering</td>
<td>Applied Science</td>
</tr>
<tr>
<td>CIVL</td>
<td>School of Civil Engineering</td>
<td>Engineering</td>
</tr>
<tr>
<td>CMED</td>
<td>School of Community Medicine</td>
<td>Medicine</td>
</tr>
<tr>
<td>COMP</td>
<td>School of Computer Science &amp; Engineering</td>
<td>Engineering</td>
</tr>
<tr>
<td>ECOH</td>
<td>Department of Economic History</td>
<td>Commerce &amp; Economics</td>
</tr>
<tr>
<td>ECON</td>
<td>School of Economics, Departments of Econometrics and Economics</td>
<td>Commerce &amp; Economics</td>
</tr>
<tr>
<td>ELEC</td>
<td>School of Electrical Engineering</td>
<td>Engineering</td>
</tr>
<tr>
<td>ENVS</td>
<td>Faculty of Biological &amp; Behavioural Sciences</td>
<td></td>
</tr>
<tr>
<td>FIBR</td>
<td>School of Fibre Science &amp; Technology</td>
<td>Applied Science</td>
</tr>
<tr>
<td>FINS</td>
<td>School of Banking &amp; Finance</td>
<td>Commerce &amp; Economics</td>
</tr>
<tr>
<td>FOOD</td>
<td>Department of Food Science and Technology</td>
<td>Applied Science</td>
</tr>
<tr>
<td>FUEL</td>
<td>Department of Fuel Technology</td>
<td>Applied Science</td>
</tr>
<tr>
<td>GEOG</td>
<td>School of Geography</td>
<td>Applied Science</td>
</tr>
<tr>
<td>GEOL</td>
<td>Department of Applied Geology</td>
<td>Applied Science</td>
</tr>
<tr>
<td>GSBE</td>
<td>Graduate School of the Built Environment</td>
<td>Built Environment</td>
</tr>
<tr>
<td>HEAL</td>
<td>School of Health Services Management</td>
<td>Professional Studies</td>
</tr>
<tr>
<td>INDC</td>
<td>Department of Industrial Chemistry</td>
<td>Applied Science</td>
</tr>
<tr>
<td>INFS</td>
<td>School of Information Systems</td>
<td>Commerce &amp; Economics</td>
</tr>
<tr>
<td>IROB</td>
<td>School of Industrial Relations &amp; Organizational Behaviour</td>
<td>Commerce &amp; Economics</td>
</tr>
<tr>
<td>KCME</td>
<td>Key Centre for Mines</td>
<td>Applied Science</td>
</tr>
<tr>
<td>Prefix</td>
<td>Organizational Unit</td>
<td>Faculty/Board</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>LAND</td>
<td>School of Landscape Architecture</td>
<td>Built Environment</td>
</tr>
<tr>
<td>LEGT</td>
<td>Department of Legal Studies &amp; Taxation</td>
<td>Commerce &amp; Economics</td>
</tr>
<tr>
<td>LIBS</td>
<td>School of Information, Library and Archive Studies</td>
<td>Professional Studies</td>
</tr>
<tr>
<td>MANF</td>
<td>School of Mechanical &amp; Manufacturing Engineering</td>
<td>Engineering</td>
</tr>
<tr>
<td>MARK</td>
<td>School of Marketing</td>
<td>Commerce &amp; Economics</td>
</tr>
<tr>
<td>MATH</td>
<td>School of Mathematics</td>
<td>Science</td>
</tr>
<tr>
<td>MATS</td>
<td>School of Materials Science &amp; Engineering</td>
<td>Applied Science</td>
</tr>
<tr>
<td>MECH</td>
<td>School of Mechanical &amp; Manufacturing Engineering</td>
<td>Engineering</td>
</tr>
<tr>
<td>MEED</td>
<td>School of Medical Education</td>
<td>Medicine</td>
</tr>
<tr>
<td>MICR</td>
<td>School of Microbiology &amp; Immunology</td>
<td>Biological &amp; Behavioural Sciences</td>
</tr>
<tr>
<td>MINE</td>
<td>Department of Mining Engineering</td>
<td>Applied Science</td>
</tr>
<tr>
<td>MINP</td>
<td>Centre for Minerals Engineering</td>
<td>Applied Science</td>
</tr>
<tr>
<td>MNGT</td>
<td>Australian Graduate School of Management</td>
<td></td>
</tr>
<tr>
<td>MSCI</td>
<td>Board of Studies in Science &amp; Mathematics</td>
<td>Science</td>
</tr>
<tr>
<td>PHYS</td>
<td>School of Physics</td>
<td></td>
</tr>
<tr>
<td>PLAN</td>
<td>School of Town Planning</td>
<td>Built Environment</td>
</tr>
<tr>
<td>POLY</td>
<td>Department of Polymer Science</td>
<td>Applied Science</td>
</tr>
<tr>
<td>PSYC</td>
<td>School of Psychology</td>
<td>Biological &amp; Behavioural Sciences</td>
</tr>
<tr>
<td>PTRL</td>
<td>Department of Petroleum Engineering Studies</td>
<td>Applied Science</td>
</tr>
<tr>
<td>SAFE</td>
<td>Department of Safety Science</td>
<td>Applied Science</td>
</tr>
<tr>
<td>SOCI</td>
<td>School of Sociology</td>
<td>Arts &amp; Social Sciences</td>
</tr>
<tr>
<td>SURV</td>
<td>School of Surveying</td>
<td>Engineering</td>
</tr>
<tr>
<td>TEXT</td>
<td>Department of Textile Technology</td>
<td>Applied Science</td>
</tr>
<tr>
<td>WOOL</td>
<td>Department of Wool &amp; Animal Science</td>
<td>Applied Science</td>
</tr>
</tbody>
</table>
Faculty Information

Some People Who Can Help You

If you require advice and information of a general nature contact: Mr G. Baldwin, Senior Administrative Officer, Room 1013, Applied Science Building. Tel. 697 4469

For information and advice of a specific nature, contact the appropriate school representative below:

- **Applied Geology** Ms. Bruce, Administrative Assistant, Room 916, Applied Science Building. Tel. 697 4262
- **Biotechnology** Ms R. Lee, Administrative Assistant, Room 110A, Biological Sciences Building. Tel. 697 2050
- **Chemical Engineering and Industrial Chemistry** Ms L. Woodcock, Administrative Officer, Room 316, Applied Science Building. Tel. 697 4318.
- **Food Science and Technology** Mr R. Greenwood, Administrative Officer, Room 115, Building B8A. Tel. 697 4364.
- **Geography** Ms C. Bilic, Administrative Assistant, Room 143, Geography and Surveying. Tel. 697 4390.
- **Materials Science and Engineering** Mr O. Andersen, Administrative Assistant, Room 110B, Materials Science and Engineering Building. Tel. 697 4436.
- **Mining Engineering** Ms L. Henry, Administrative Assistant, Room 159C, Main Building. Tel. 697 4516.
- **Petroleum Engineering** Ms J. Lippatt, Room 115, Petroleum Engineering Building. Tel. 697 5188.
- **Textile Technology** Ms F. Colville, Administrative Officer, Room 102, Sir Robert Webster Building. Tel. 697 4477.
- **Wool and Animal Science Assoc.** Professor J. Kennedy, Room 256, Sir Robert Webster Building. Tel. 697 4482.
- **Safety Science** Ms B. Littlewood, Administrative Assistant, Hut B, 11a, Room111. Tel. 697 4144.

Enrolment Procedures

All students re-enrolling in 1993 should obtain a copy of the free leaflet *ReEnrolling in 1993* available from School Offices and the Admissions Office. This leaflet provides detailed information on enrolment procedures and fees, enrolment timetables by Faculty and course, enrolment in miscellaneous subjects, locations and hours of Cashiers and late enrolments.

Students With Disabilities

The University of New South Wales has a policy of equal opportunity in education and seeks wherever possible to ensure maximum participation of students with disabilities. The University offers a range of assistance: examination support; specialized equipment; educational support; parking provisions; library assistance.

A Resource Guide for students and staff with disabilities and a map showing wheelchair access is available from the Adviser to Students with Disabilities, EEO Unit, Library and the Students Union.

It is advisable to make contact with the Adviser to Students with Disabilities prior to, or immediately following enrolment, to discuss your support needs.

The Adviser can be contacted on 697 5418 or at Student Services, Quadrangle Building.

Student Clubs and Societies

Students have the opportunity of joining a wide range of clubs and societies. Many of these are affiliated with the Students' Union. There are numerous religious, social and cultural clubs and also many sporting clubs which are affiliated with the Sports Association.

Clubs and societies seeking to use the name of the University in their title, or seeking University recognition, must submit their constitutions either to the Students' Union or the Sports Association if they wish to be affiliated with either of these bodies, or to the Registrar for approval by the University Council.
Applied Sciences Library Facilities

Although any of the university libraries may meet specific needs, the staff and students of the Faculty of Applied Science are served mainly by the Biomedical Library and the Physical Sciences Library.

The Biomedical Library

The Biomedical Library provides library services for staff and students from the Faculties of Medicine and Biological and Behavioural Sciences, the Schools of Applied Bioscience, Health Services Management, Fibre Science and Technology, and the Department of Safety Science. It is closely associated with the libraries of the teaching hospitals of the University.

The Biomedical Library is located on Levels 2, 3 and 4 of the Mathews Building Annexe and is connected to the other Special Libraries via a link through the undergraduate collection.

Professional staff are available at the Reader Assistance Unit on Level 2 to provide reference services and to assist in the use of the catalogues. Instructional classes in the use of the online catalogue. Instructional classes in the use of the library and in specific subject material can be arranged through the Reader Assistance Unit.

Serials in the Biomedical Library are now shelved in alphabetical order by title and carry the prefix 'MB'.

Details about Biomedical Library books, serials and audiovisual material can be found in the Library Catalogue, (OPAC).

The Biomedical Library offers the following facilities: computerized literature searches; a wide range of Databases on CDROM; remote access to databases on CDROM and current contents throughout the campus; access to the Family Medicine Program (MCQ self assessment); interlibrary loans.

Biomedical Librarian: Monica Davis

The Physical Sciences Library

This library, situated on Levels 6 and 7 of the Library tower, caters for the information needs of staff, postgraduate and undergraduate students in the pure and applied sciences, engineering and architecture.

Physical Sciences Library materials are listed in the Library's online catalogues, microfiche book finding list or microfiche serials catalogue.

The Library provides reference, reader assistance and reader education services, including interlibrary loan, online search and CDROM facilities. Photocopying facilities are also available.

Trained Library staff are always available on Level 7 to assist readers with their enquiries.

Physical Sciences Librarian: Rhonda Langford

Conditions for the Award of the Degree of Bachelor of Science or Bachelor of Engineering

The courses leading to the award of the degree of Bachelor of Science or Bachelor of Engineering in the Faculty of Applied Science are programmed over four years of full-time study. The normal programs may be varied by the Head of the School in which the student is enrolled. The regulations governing the award of these degrees are as follows:

1. A candidate for the award of the degree of Bachelor of Science or Bachelor of Engineering shall;
   (1) comply with the requirements for admission;
   (2) follow the prescribed course of study in the appropriate School, and satisfy the examiners in the necessary subjects;
   (3) complete an approved program of industrial or similar training for such periods as are prescribed.

2. A student may be granted advanced standing by the Professorial Board on the recommendation of Faculty, but in each case must complete the appropriate period of approved industrial training before being eligible for the award of the degree.

3. The degree shall be awarded at Pass or Honours levels. Honours may be awarded in the following categories: Honours Class I; Honours Class II, Division I; Honours Class II, Division II.

4. Students shall be required to conform with the general rules relating to University courses.

Conditions for the Award of the Degree of Bachelor of Science (Technology) or Bachelor of Science (Engineering)

The courses leading to the award of the degree of Bachelor of Science (Technology) or Bachelor of Science (Engineering) in the Faculty of Applied Science are normally programmed over six years of part-time study in the University whilst the student is employed in industry. The normal programs may be varied by the Head of the School in which the student is enrolled. The regulations governing the award of these degrees are as follows:

1. A candidate for the award of the degree of BSc(Tech) or BSc(Eng) shall:
   (1) comply with the requirements for admission;
   (2) follow the prescribed course of study in the appropriate school and pass the necessary examinations;
   (3) complete an approved program of industrial or similar training for such periods as are prescribed.

2. A student may be granted advanced standing by the Professorial Board on the recommendation of Faculty.
3. The degree of BSc(Tech) and BSc(Eng) shall be awarded at Pass level only but in the case of superior performance throughout the course the degree shall be conferred 'with merit'.
4. Students shall be required to conform with the general rules relating to University courses.

General Education Requirement

The University requires that all undergraduate students undertake a structured program in General Education as an integral part of studies for their degree.

Among its objectives, the General Education program provides the opportunity for students to address some of the key questions they will face as individuals, citizens and professionals.

There are differing requirements for general education for students commencing before, in, and after 1988. Students must complete a program of general education in accordance with the requirements in effect when they commenced their degree program. Students should consult the appropriate course authority or the Centre for Liberal and General Studies in Morven Brown Building, Room G58.

The program requires students to undertake studies in three categories of the program: The key questions addressed by the Program are:

**Category A: The External Context:** An introduction in nonspecialist terms to an understanding of the environments in which humans function.

*Course Requirement: 56 hours*

1. Australia and the Development of the World Economy. How do we, can we, generate wealth?
2. Human Inequality. How can we, ought we, distribute wealth, status and power?
3. Science and Civilization. What steps should we take, and what policies should we adopt, in science and technology?
4. Ecosystems, Technology and Human Habitation. What effects do our wealth generating and technoscientific activities have on the environment?
5. Mass Media and Communication. What are the effects of the new mass media of communication?
6. Australian Society and Culture. What are the key social and cultural influences on Australia today?

**Category B: The Internal Context of Assumptions and Values:** An introduction to, and a critical reflection upon, the cultural bases of knowledge, belief, language, identity and purpose.

*Course Requirement: 56 hours*

1. The Self and Society. How do we define ourselves in relation to the larger human community?
2. Changing Conceptions of Human Nature and WellBeing. How do our conceptions of human nature and well being influence both individual and social behaviour?
3. The Pursuit of Human Rationality. What are the prevailing conceptions of and challenges to human rationality?
4. The Use of Language, Images and Symbols. How do language, images and symbols function as means and media of communication
5. The Computer: Its Impact, Significance and Uses. What is the impact of the computer on human society and culture?
6. Beliefs, Values and the Search for Meaning. Which systems of belief and configurations of values are most conducive to the survival and enhancement of the human species and the planet earth?

**Category C: An Introduction to the design and responsible management of the human and planetary future:** An introduction to the systems over which human beings exercise some influence and control. This category is required only of students in four-year professional and honours programs.

The central question to be addressed by students in a systematic and formal way is: For what purpose or purposes will I use my intellectual skills, my expertise, or my technological prowess?

Will these abilities be used, for example:
- in a creative and innovative way?
- to widen the circle of human participation in the benefits they bring?
- to break down the barriers of exclusion and discrimination?
- to enhance the prospects for survival of the human species?
- to enhance the capacity of the planet earth to sustain life?

In the Faculty of Applied Science most undergraduates take a Faculty subject APSE0002 Social Issues in Applied Science in the 4th year of their course as partial satisfaction of the Category C requirement. Completion of the Category C requirement differs across the Faculty and the details are shown under each School's handbook entry.
Undergraduate Study: Course Outlines

The Faculty of Applied Science consists of the Schools of Applied Bioscience, Chemical Engineering and Industrial Chemistry, Fibre Science and Technology, Geography, Materials Science and Engineering, Mines and the Centre for Petroleum Engineering. These Schools offer full-time undergraduate courses leading to the degree of Bachelor of Science or Bachelor of Engineering, and some of the Schools also offer part-time courses leading to the award of the degree of Bachelor of Science (Technology).

Full-time Courses

Full-time courses of four years' duration leading to the award of the degree of Bachelor of Science are offered in Applied Geography, Applied Geology, Food Science and Technology, Industrial Chemistry, Textile Technology, Textile Management and Wool and Pastoral Sciences. Four-year courses leading to the award of the degree of Bachelor of Engineering are offered in Ceramic Engineering, Chemical Engineering, Mining Engineering and Petroleum Engineering. A four-year course leading to the award of a Bachelor of Metallurgical Engineering is offered in Metallurgical Engineering and a Bachelor of Materials Engineering is offered in Materials Engineering.

Honours: In all courses the degree may be awarded with Honours. The award of Honours is determined by performance in subjects and in the final-year project. Honours are awarded in Class 1; Class 2 Division 1; and Class 2 Division 2.

Industrial Training Requirements: In the scientific and technological courses close association with industry is maintained on the practical aspects of the professions. This is achieved in most of the courses of the Faculty by expecting students to complete an approved industrial training program prior to graduation. This is normally carried out during the Summer Recess. In the case of Wool and Pastoral Sciences, students are required to complete twenty-four weeks' approved practical work. In Mining Engineering students will undertake a program of practical training of at least 100 days.

Part-time Courses

Six-year part-time courses leading to the award of the degree of Bachelor of Science (Technology) are offered by the Department of Food Science and Technology in the School of Applied Bioscience; in Industrial Chemistry by the School of Chemical Engineering and Industrial Chemistry; and in Metallurgy and Ceramics by the School of Materials Science and Engineering.

The BSc(Tech) degree courses are intended for students who are employed in relevant industries and who wish to prepare for a degree mainly by part-time attendance. As part of the requirements for the award of the BSc(Tech) degree, students are required to complete an approved program of industrial training of not less than one year prior to the award of the degree. Industrial training should normally be completed concurrently with attendance in the course, but with the approval of the Head of School, may be completed after completion of the prescribed course of study.

Students who qualify for the award of the BSc(Tech) degree in the Faculty of Applied Science and who wish to proceed to the award of a BSc or BE degree will normally be required to complete further work which will involve at least one year of full-time attendance.

Holders of the degree of BSc(Tech) or BSc(Eng) will be eligible to proceed to the award of the degree of Master of Science, Master of Engineering or Master of Applied Science, subject to the regulations relating to these degrees.

Transfer is also possible from full-time courses to the part-time BSc(Tech) degree course, but a period of approved industrial experience must be gained before graduation. This requirement will apply to students transferring from BSc and BE degree courses within the Faculty.

Graduate Study: Course Outlines

Enrolment Procedures

All students enrolling in graduate courses should obtain a copy of the free leaflet ReEnrolling 1993 for Postgraduate Students available from School Offices and the Admissions Office. This leaflet provides detailed information on enrolment procedures and fees, enrolment timetables by faculty and course, enrolment in miscellaneous subjects, locations and hours of Cashiers and late enrolments.

Graduate Study

The Faculty provides facilities for students to proceed to the award of the higher degrees of Doctor of Philosophy, Master of Engineering, Master of Science, Master of Applied Science, Master of Safety Science, Master of Engineering Science (Industrial Safety), and Master of Environmental Studies. Courses leading to the award of a Graduate Diploma are also offered. The degree of Doctor of Science is awarded for a contribution of distinguished merit in the fields of science, engineering or applied science.
The degrees of Doctor of Philosophy, Master of Engineering and Master of Science are all awarded for research and require the preparation and submission of a thesis embodying the results of an original investigation or design. Candidates for the Doctorate of Philosophy are normally involved in at least three years work. The work for the award of a Master's degree may be completed in a minimum of one year, but normally requires two years of study for full-time students, and equivalent time for part-time students.

The Faculty offers courses leading to the award of the degree of Master of Applied Science. The institution of this degree springs from the recognition of the considerable advance of knowledge in the fields of applied science and engineering which has marked recent years and the consequent increased scope for advanced formal instruction in these fields. Students are usually in attendance at the University for one year on a full-time basis or for two years part-time.

The Faculty offers a course leading to the award of the degree of Master of Environmental Studies. This is an interdisciplinary course designed to study the nature of environmental problems and the evaluation methodology. Students are usually in attendance at the University for one year on a full-time basis or for two years part-time.

The Master of Engineering Science course in Industrial Safety is flexible and designed for engineers who manage safety as part of their line management role or for specialist safety engineers who do not require the broad based MSafetySc course. Students are usually in attendance for one year full-time or for two years part-time.

The Master of Mining Management is designed to give mining personnel the opportunity to extend their career paths into management levels. Course work modules can be selected from Business Management and Science and Technology streams. Students are usually in attendance for two years on a part-time basis.

The Master of Safety Science course is a broad based course which gives a grounding in all the disciplines which are essential to safety, together with electives in specialist areas such as ergonomics, occupational hygiene, safety management or safety engineering. Students are required to study for a minimum of eighteen months full-time or three years part-time.

Courses are also offered at the graduate level leading to the award of a Graduate Diploma. Students are required to attend courses of study for one year full-time or two years part-time. The courses available for the Graduate Diploma are Arid Land Management, Biochemical Engineering, Biotechnology, Corrosion Technology, Ergonomics, Food Technology, Mining and Mineral Engineering, Mining Management, Remote Sensing, Safety Sensing, Textile Technology and Wool and Pastoral Sciences and Petroleum Engineering.

Candidates may register for all the research degrees subject to adequate research facilities and satisfactory supervision being available in the candidate's particular field of study. Where special conditions can be met the Faculty may grant permission to a candidate to enrol for the degree of Doctor of Philosophy on a part-time basis.

The conditions governing the award of the various higher degrees and graduate diplomas are set out later in this handbook in Conditions for the Award of Higher Degrees.

Short, intensive graduate and special courses are provided throughout each year designed to keep practising scientists and technologists in touch with the latest developments in their various fields.

MBT Program
Graduate School of Engineering

The MBT Program is a joint program of the Faculties of Applied Science and Engineering. However, candidates enrol through the Faculty of Engineering. Principal amongst the aims and objectives of the MBT Program is a commitment to developing and enhancing links with industry and in so doing improve the quality and relevance of tertiary education and research services to the private and public sectors.

The MBT program is strongly aligned to the open learning principles used in the Graduate Management Qualification (GMQ) developed by the Australian Graduate School of Management (AGSM) in order to maintain the University's unique standard of excellence in the professional development of managers. Subjects from the Industrial Management Qualification (IMQ), the first in the series of articulated courses of the MBT Program, complement those of the GMQ so that is is possible to use subjects from both to qualify for the Master's award.

The two courses currently offered through the Graduate School of Engineering are the Master of Business and Technology and the Graduate Diploma in Industrial Management. Both are full fee paying courses.

These courses aim to produce fully professional engineers with advanced management training. The courses involve open learning principles, including a modular structure with manual-type text material which students work through in their free time and approximately 1.5 hours tutorials per week. There are three levels of attainment each of which is recognized by a formal qualification; the Industrial Management Qualification (IMQ), the Graduate Diploma and the Master's Degree.

Further information can be obtained from Professor C. Patterson, Head of the Graduate School of Engineering.
Department of Biotechnology

Biotechnology can be defined as the use of various biological processes to make products and perform services. The essential feature of biotechnology therefore is the use of biological processes based on living cells and biochemical macromolecules such as proteins, DNA and RNA in a rapidly expanding range of activities of benefit to mankind. As such, biotechnology makes practical use of the recent scientific advances in areas such as molecular genetics.

The development of recombinant-DNA (r-DNA) technology has resulted in the ability to produce large quantities of any potentially useful product. Based on this technology, a new generation of biopharmaceuticals, including hormones, vaccines, anti-hypertensive and anti-inflammatory agents, are being developed which have the potential to revolutionise medicine. Microorganisms and viruses are being modified for use in controlling plant and animal diseases and pests. Diagnostic kits are being developed for use in forensic science and in product identification and quality control. In addition, genetic improvements in agriculture, plants and animals are becoming a reality, as is the control of inborn genetic disorders in humans.

Some aspects of biotechnology are traditional, having been used for centuries. The first makers of bread, cheese and fermented beverages over six thousand years ago were applying biotechnological principles in processing these goods. Without understanding the processes they were operating, they were in fact making use of catalysis mediated by microbial cells. Such processes are still in use today and scientific advances now allow for much greater control of the processes with resultant improvements in quality and economics of production. The number of such biological processes has also expanded and enzymes and/or microorganisms are used in the production of a wide range of fermented foods (such as cheese, wine, beer, soy sauce, sauerkraut, yoghurt, kefir) and in the production of flavouring, colouring and sweetening agents.

Bioprocesses are also used in the extraction of minerals from low grade ores, and modified and novel bioprocesses are being developed for the treatment of waste and degradation of recalcitrant molecules, an area of vital importance in our increasingly polluted planet.

The future for expansion in all the above areas is immense, and an ability to cope with the problems of the 21st century will be heavily dependent on these advances.

The Department of Biotechnology offers undergraduate training in the BE Degree Course in Bioprocess Engineering, the BSc Degree Course in Biotechnology and in the BSc Degree Course through the Board of Studies in Science & Mathematics. The BE Course in Bioprocess Engineering is four years full-time and has been designed to meet the requirements for membership of the Institution of Engineers, Australia. The BSc (Biotechnology) Course is four years full-time and awarded with Honours to students who have distinguished themselves in coursework and in the final year project. The BSc Course through the BSSM is three years for a Pass degree during which the student can study aspects of biotechnology in combination with another major in a relevant discipline, preferably biochemistry, microbiology or chemistry. The fourth Honours Year of this BSc Course includes further formal training in biotechnology as well as an extensive research project. Details on both the Pass and Honours BSc Course majoring in biotechnology are given in the Faculty of Science Handbook.
General Education Electives

For details of the General Education requirements see Faculty Information.

Department of Food Science and Technology

Food Technology is the understanding and application of basic sciences to the management of foods from the time of production, through processing and distribution, until their use by the consumer. It is concerned with food quality and quantity, with nutritional status and safety, and with means of production, processing, preservation, distribution and utilization.

A study of food science and technology brings many scientific disciplines into focus. Its basis is in areas of chemistry, biochemistry and microbiology, and its borders merge with those of agriculture, engineering, nutrition, commerce, psychology and law. Biotechnology has a role of increasing importance in food science and technology.

The food technologist acquires new knowledge by laboratory and process research, and applies it to the development of acceptable foods, beverages and food ingredients by optimum processes and equipment. Foods are studied in terms of their basic constituents and the changes they undergo when subjected to modern processing and distribution. The technologist is equally concerned with the development and selection of raw materials from agricultural, horticultural, animal and marine sources.

The food and beverage processing industry is the largest sector of Australian manufacturing industry. Internationally, food production, food processing and food service are amongst the largest and most stable industries in the world.

The challenges facing these industries include increasing the availability, variety, quality and quantity of foods in line with the needs and expectations of an ever-increasing world population. Thus, there is a demand at both national and international levels for professionally trained people who are prepared to accept responsibility for the quality and safety of human food.

The Department offers a four-year full-time course leading to the award of the degree of Bachelor of Science and six-year part-time course leading to the award of the degree of Bachelor of Science (Technology). Graduates of both courses qualify for membership of the Royal Australian Chemical Institute, the Australian Institute of Food Science and Technology, and the US Institute of Food Technologists.

Graduate Diploma and Master of Applied Science courses in Food Technology of one year full-time or two years part-time are designed for graduates in science or agriculture wishing to familiarize themselves with the principles of food technology. Master of Applied Science courses in Food Microbiology and Food Engineering are also offered.

General Education Electives

For details of the General Education requirements see Faculty Information.

Undergraduate Study

Course Outlines

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<td>6</td>
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<tr>
<td>PHYS1022</td>
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<td>Totalling</td>
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</table>

This course is designed to provide depth and breadth in the relevant physical and biological sciences on which food science and technology is based. Students completing the Year 1 requirements are eligible for selection for admission to Year 2 of the course.
### Undergraduate Study ABIO 23

#### Principles of Biochemistry and Molecular Biology

- **CHEM2819** Physical Chemistry for Food and Fibre Science & Technology 0 6
- **CHEM2021** Organic Chemistry 5 1
- **CHEM2041** Chemical and Spectroscopic Analysis 0 6
- **FOOD310** Introductory Nutrition 3 0
- **FOOD4210** Introductory Food Engineering 3 0
- **MATH2819** Statistics SA 2 2
- **MICR2218** Microbiology 6 2

**Totalling:** 25 23

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### Year 3

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<tr>
<td>BIOT3041</td>
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<td>CHEM3926</td>
<td>Analytical Instrumentation</td>
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<td>CHEM3929</td>
<td>Food Chemistry</td>
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<td>FOOD1310</td>
<td>Food Preservation</td>
<td>6 0</td>
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<tr>
<td>FOOD1320</td>
<td>Plant Food Science</td>
<td>2 0</td>
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<td>FOOD1330</td>
<td>Animal Food Science</td>
<td>3 0</td>
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<tr>
<td>FOOD1340</td>
<td>Quality Evaluation and Control</td>
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<tr>
<td>FOOD1350</td>
<td>Food Technology Laboratory</td>
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<td>Food Microbiology</td>
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<tr>
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**Totalling:** 24 24

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*These subjects contribute to satisfaction of the Category-C General Education requirement.*

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### Year 4

- **APSE0002** Social Issues in Applied Science* 2 0
- **FOOD1400** Project 8 8
- **FOOD1410** Field Excursions 3 0
- **FOOD1420** Food Legislation 2 0
- **FOOD1430** Food Industry Management* 2 0
- **General Education Subject/s Category B** 0 4

**Totalling:** 17 12

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*These subjects contribute to satisfaction of the Category-C General Education requirement.*

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### Detailed reports of the students' activities during their visits are required.

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### 3070

#### Food Science and Technology - Part-time Course

**Bachelor of Science (Technology)**

**BScTech**

This course is designed for students who are employed in the food processing industries. It extends over six part-time years of study, and leads to the award of the degree of Bachelor of Science (Technology). Students are required to complete an approved program of industrial training of not less than twelve months prior to the award of the degree. Industrial training should normally be completed concurrently with attendance in the course, but with the approval of the Head of Department may be completed after completion of the prescribed course of study.

The course covers the same subject matter as the first three years of the full-time course. For the first two years students follow a common course in which general biology is taken, and thereafter specialize in the biological sciences, which are fundamental to the study of food science and technology. The subjects of Stages 4, 5 and 6 may be available only in daytime classes, and substantial daytime release from industry may be required. Students who have completed the requirements of this course and have qualified for the award of the degree of Bachelor of Science (Technology) may proceed to the award of the degree of Bachelor of Science by attending for one full-time year and completing the subjects listed in Year 4 of the full-time course. Students desiring to proceed to the award of a BSc degree must apply to the Head of the Department not later than 31 December of the year in which the sixth stage is completed.

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### Stages 1 and 2*

<table>
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<td>MATH1021</td>
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<tr>
<td>PHYS1002</td>
<td>Physics 1 or</td>
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<tr>
<td>PHYS1022</td>
<td>Introductory Physics 1</td>
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*These subjects contribute to satisfaction of the Category-C General Education requirement.*

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### Stage 3

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<td>Organic Chemistry</td>
<td>0 6</td>
</tr>
<tr>
<td>FOOD1440</td>
<td>Food Quality and Product Development</td>
<td>0 6</td>
</tr>
<tr>
<td>FOOD1450</td>
<td>Food Processing Wastes</td>
<td>0 3</td>
</tr>
<tr>
<td>FOOD1460</td>
<td>Cereal Technology</td>
<td>6 0</td>
</tr>
<tr>
<td>FOOD1470</td>
<td>Postharvest Technology of Foods</td>
<td>6 0</td>
</tr>
<tr>
<td>FOOD2410</td>
<td>Advanced Food Microbiology</td>
<td>0 6</td>
</tr>
<tr>
<td>FOOD2420</td>
<td>Yeast Technology</td>
<td>3 0</td>
</tr>
<tr>
<td>FOOD3410</td>
<td>Advanced Nutrition</td>
<td>6 0</td>
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<tr>
<td>FOOD4410</td>
<td>Advanced Food Engineering</td>
<td>3 0</td>
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<td>FOOD4420</td>
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<tr>
<td>MANF0420</td>
<td>Production Management</td>
<td>6 0</td>
</tr>
<tr>
<td>MARK2012</td>
<td>Marketing Fundamentals</td>
<td>4 0</td>
</tr>
<tr>
<td>MARK2052</td>
<td>Marketing Research</td>
<td>0 4</td>
</tr>
</tbody>
</table>

or such other electives, to a total of not less than 8.5 hours per week, as approved by the Head of Department (17 credits).

During Years 3 and 4 of the course excursions are made to various food industries. Detailed reports of some of these visits are required.
### 3052

**Biotechnology - Full-time Course**

**Bachelor of Science**

**BSc**

This course in Biotechnology offers a comprehensive education in all aspects of modern applied biology. It leads to the award of a Bachelor of Science Degree over four years full-time study, with Honours for students who perform with merit.

Graduates in Biotechnology will be able to find employment in industries and other organisations involved with biopharmaceutical production and food processing, as well as in agricultural and environmental biotechnology.
Bioprocess Engineering - Full-time Course

Bachelor of Engineering
BE

The first two years of the course are similar to the first two years of the Chemical Engineering degree course with the addition of basic training in Biology. The third year of the course contains basic training in Biochemistry, Microbiology as well as the Chemical Engineering units and an introduction to Bioprocess Engineering which will be further developed in the fourth year. The course has been designed so that graduates can find employment in the fermentation, food processing, pharmaceutical, agro-industrial and waste treatment industries.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

APSE0002
Social Issues in Applied Science
Staff Contact: Faculty Office
S1

The subject covers social issues arising from future technological developments and the role that a professional applied scientist can play in influencing future directions. It will be taught by a combination of group activity, case studies and projects and seminars from visiting speakers, some of whom will be from disciplines other than the applied sciences.
Department of Biotechnology

BIOT3011
Biotechnology A  
Staff Contact: Prof N Dunn  
S1 L3 T3  
Prerequisite: BIOT3100  
The basic principles involved in the operation of microbial processes on an industrial scale. Includes: the selection, maintenance and improvement of microorganisms; the influence of physical and chemical factors on the microbial environment; the control of environmental factors; the effects of operational patterns on batch and continuous flow cultivation; aeration and agitation; scale-up of microbial processes; air and media sterilization; the harvesting, purification and standardization of products; the principles involved in microbial processes for chemical, pharmaceutical and food production, microbial waste treatment and environmental control. The laboratory component includes manipulation of microorganisms, laboratory-scale fermentor operation, microbial enzyme isolation, visits to industrial fermentation plants and industrial seminars.

BIOT3021
Biotechnology B  
Staff Contact: Prof P Rogers  
S2 L2 T4  
Prerequisite: BIOT3011  
Application of principles of biotechnology to the analysis and design of microbial processes of industrial relevance (antibiotics, microbial enzymes, single cell protein from carbohydrates and hydrocarbons, fermented foods and beverages, amino acids and vitamins, microbial polysaccharides, activated sludge and photosynthetic processes for waste treatment, microbial leaching of low-grade minerals). Emphasis on quantitative approach: mass and heat balance calculations, kinetic and thermodynamic analysis, detailed equipment design and specification, process design and layout, process simulation, plant location, application of optimization techniques. The economics of microbial processes are considered and comparison made with alternative modes of production or treatment. The economics of agroindustry in Australia using microbial processes. Marketing of fermentation products, clinical trials required, legal constraints, patent rights. Technical and economic feasibility studies, and a design project.

BIOT3031
Microbial Genetics  
Staff Contact: Dr S Delaney  
S1 L2 T4  
Prerequisites: BIOS2011, BIOS2021, BIOT3100 and MICR2011  
Note/s: Excluded MICR3021.  
This unit is suitable for students majoring in Microbiology, Biochemistry, Biotechnology or Genetics. It deals with major aspects of the genetics of bacteriophage, bacteria and yeast. Topics include plasmids and transposable genetic elements, gene transfer, mutagenesis and DNA repair, mutants, bacteriophage genetics, gene cloning (vectors, recombinant-DNA techniques) and genetics of nitrogen fixation.

BIOT3041
Principles of Biotechnology  
Staff Contact: Prof N Dunn  
S1 L3  
Prerequisites: BIOT3011 and MICR3021  
Lecture component of BIOT3011 Biotechnology A.

BIOT3051
Biotechnology Laboratory  
Staff Contact: Prof N Dunn  
S1 T3  
Prerequisite: BIOT3041  
Laboratory component of BIOT3011 Biotechnology A.

BIOT3061
Monoclonal Antibody and Genetic Techniques in Biotechnology  
Staff Contact: Dr S Mahler  
S2 L2 T4  
Prerequisite: BIOT3011  
Recent developments in biotechnology have resulted in techniques which are widely applied in industrial, clinical, veterinary, agricultural and research laboratories. Many of these techniques have resulted from the development of monoclonal antibodies and the development of gene probes. The course includes: antibody structure; production of monoclonal antibodies, cell fusion, hybridoma selection, culture techniques, purification; analytical techniques employing monoclonal antibodies (RIA, ELISA); therapeutic application of antibodies, immunotoxins; gene probes; restriction fragment length polymorphisms (RFLP); gene probes for disease detection, identification of bacteria and viruses; forensic application of DNA fingerprinting. Tutorial and practical work to complement the lectures.

BIOT3100
Fermentation Processes  
Staff Contact: Prof P Gray  
S2 T2  
Factors governing the use of microorganisms in industrial processes, including the selection, maintenance and improvement of microorganisms, the control of environmental factors, batch and continuous flow operational patterns, product recovery, process optimization and waste disposal. Demonstrations of the operation and control of fermenter systems and of microbial process simulation.

BIOT4063
Research Project  
Staff Contact: Prof P Rogers  
S1 T2 S2 T10  
Prerequisites: BIOT4073 and/or BIOT4083  
Biotechnology Honours  
Staff Contact: Prof N Dunn  
Advanced formal training in selected areas of biotechnology and participation in one of the school's research projects.

BIOT4093
Biological Process Engineering  
Staff Contact: Department Office  
F L2 T4  
Prerequisite: MICR2201

Department of Food Science and Technology

FOOD1310
Food Preservation
Staff Contact: Prof K. A. Buckle
S1 L3 T3
Prerequisites: BIOC2312, CHEM2021, CHEM2041, CHEM2819, FOOD3210, FOOD4210, MICR2218
Introduction to food preservation; spoilage control by traditional and modern techniques. Technology of food preservation by heating, chilling and freezing, sun drying and dehydration. Use of salt, sugar, acid, chemical preservatives, ionizing radiations, modified atmospheres in food preservation. Chemical and microbial stability of foods. Packaging requirements for preserved foods. Water relations of foods. An integrated program of laboratory and pilot plant exercises designed to illustrate the principles and procedures presented in the lecture course.

FOOD1320
Plant Food Science
Staff Contact: Dr C.M.C. Yuen
S1 L2
Prerequisites: BIOC2312, CHEM2021, CHEM2041, CHEM2819, FOOD3210, FOOD4210, MICR2218
Cereals: Structure, composition, properties and uses of cereal grains with emphasis on wheat; processing and technology of wheat and rice. Sugars: Sources, types, properties of sugars in foods; sugar milling and refining. Fruit and vegetables: Nutrient composition; principles of postharvest physiology, storage and handling. Lipids: Sources and composition of fats and oils; methods of extraction and processing. Nonmicrobial hazards in foods: Minerals, proteins, acids, goitrogens, cyanogens, carcinogens; spices and flavours. Plant protein: Sources, composition, extraction and uses in foods with emphasis on soybean. Tea, cocoa and coffee: Production, composition and processing.

FOOD1330
Animal Food Science
Staff Contact: Dr J.E. Paton
S1 L3
Prerequisites: BIOC2312, CHEM2021, CHEM2041, CHEM2819, FOOD3210, MICR2218
Nature and distribution of world animal food resources. Meat: Muscle structure, function, slaughter, conversion of muscle to meat; chemical, biochemical factors in postmortem glycolysis; meat microbiology; chilling, freezing, curing, processing of meat and meat-derived products; processing equipment; meat marketing systems; nutritional and sensory properties of meats. Milk and dairy products: Chemical, physical properties, microbiology of milk; technology of milk-derived products including cheese, fermented products, butter, frozen, chilled and dried milk-derived foods. Marine products: Nature and distribution of world fishery resources; teleostean and elasmobranch species, spoilage mechanisms, quality assessment; preservation by chilling, freezing, salting, drying, smoking, marinating and fermentation; fish meal and fish protein concentrate. Egg products: Structure and composition of the avian egg; changes during storage of whole eggs; egg quality assessment; functional properties of egg components; preservation of the intact egg; pulping, freezing and drying of whole egg pulp, yolk and albumen.

FOOD1340
Quality Evaluation and Control
Staff Contact: Dr M. Filadelfi-Keszi
S2 L1 T1
Prerequisites: FOOD1310, FOOD1320, FOOD1330, FOOD2310, MATH2819
An introduction to food quality, its nature, assessment and control during handling, processing and storage; the use of objective and sensory methods of assessment; an introduction to HACCP, TTT and PPP concepts.

FOOD1350
Food Technology Laboratory
Staff Contact: Dr J.E. Paton
S2 T6
Prerequisites: FOOD1310, FOOD1320, FOOD1330, FOOD2310
A program of exercises integrating elements of the chemical, physical, sensory and microbiological analysis of foods and the impact of processing on these factors. The program is designed to demonstrate the application of laboratory methods to food systems. Ability to carry out test methods and to interpret results will be a major component in student assessment.

FOOD1400
Project
Staff Contact: Assoc Prof G.H. Fleet
F T8
Prerequisite: Completion of Year 3 subjects
The student undertakes an individual project involving a literature survey, an experimental investigation, the preparation of a detailed report on a selected topic in food science and technology, and presentation of seminars on a literature review and experimental results.
Food quality assessment and cereal protein analysis.

Technology of bread, biscuit, noodle, and cake production, storage, marketing, and waste management.

A treatment in greater depth of the following topics dealt with in FOOD1320: Production, storage, marketing, and quality of cereal grains; current trends in these areas. Technology of bread, biscuit, noodle, and cake manufacture. Chemical, physical, and biochemical interactions in wheat flour doughs; flour milling and assessment of flour quality. Cereal protein analysis.

Prerequisite: FOOD1350 or equivalent

Effects of waste discharges into the environment. Treatment of water for domestic and industrial applications; water reuse; process modifications for effluent reduction. Origin, composition, treatment, disposal, and utilization of wastes from food processing operations. Legal and economic aspects of waste disposal. Inspections of water and waste treatment plants.

Food processing wastes

An introduction to food industry management, accounting, finance, marketing, industrial relations, and communication skills.

Food quality and product development

The steps involved in new product development; role of market research and advertising. Costing procedures, new product failure, case studies. Practical exercises in new food product development.

Food processing wastes

A lecture and laboratory program on the ecology, biochemistry, isolation, enumeration and identification of bacteria, yeasts, fungi, and viruses associated with foods and beverages. Food spoilage: specific food microorganism associations; taxonomy and biochemistry of major spoilage species; chemical and physical changes to food properties; control; spoilage of specific commodities. Foodborne microbial disease: foods as vectors of disease and food poisoning; statistics and epidemiology; ecology and taxonomy of foodborne pathogenic microorganisms; control and prevention by hygiene, microbiological standards, and legislation. Food fermentation: microbial ecology and biochemistry of fermentations; fermentations of alcoholic beverages, bakery products, dairy products, meats, vegetables, cocoa beans, soy sauce; production of food ingredients and processing aids by fermentation. Microbiological examination of foods: sample preparation and sampling plans; sublethal injury; standard methods for determination of total plate counts, indicator organisms, foodborne pathogenic species, principal spoilage species, microbiological quality assurance: specifications and standards; decision criteria; hazard analysis and critical control point (HACCP) concept; cleaning and sanitation.

Advanced food microbiology

An advanced theoretical and practical treatment of the ecology, taxonomy, biochemistry, and analytical technology of bacteria, yeasts, fungi, and viruses associated with food spoilage, foodborne disease, and food fermentations. Emphasis on: new developments in food microbiology; economic consequences of microorganisms in foods; exploitation of microorganisms in novel processes for the production of food ingredients and processing aids; new technologies for the detection of microorganisms in foods, including enzyme immunoassay, DNA probes, bioluminescence, impedance, epifluorescent filtration methods; practical problems associated with the microbiological analysis of foods and interpretation of data.
FOOD2420
Yeast Technology
Staff Contact: A/Prof G.H. Fleet
S1 L2 T1
Prerequisite: FOOD2310
Note/s: Not offered in 1994

FOOD3210
Introductory Nutrition
Staff Contact: A/Prof H. Greenfield
S1 L2 T1
Co or Prerequisite: BIOC2312
Role of nutrients in human structure and function. Effects of diet on growth and body size. Food habits, beliefs and choice; dietary patterns. Assessment of nutritional status; anthropometry, dietary intake studies, use of dietary recommendations, food groups, tables of food composition.

FOOD3310
Nutrition
Staff Contact: A/Prof H. Greenfield
S2 L2 T1
Prerequisite: FOOD3210
Nutritional needs of vulnerable groups: infants, pregnant and lactating women, the aged. Dietary intolerance, disorders related to the affluent diet including coronary heart disease, dental caries, diabetes, hypertension and cancer. Problems of undernutrition including protein, energy, mineral and vitamin deficiencies. Physiological and nutritional aspects of dietary fibre, alcohol and food intolerance. Measurement of nutrient intake using computer systems, on individual and group basis.

FOOD3410
Advanced Nutrition
Staff Contact: A/Prof H. Greenfield
S1 L1 T5
Prerequisite: FOOD3310 or equivalent
Prerequisites: PHYS1002 or PHYS1022 and MATH1032 or MATH1011 and MATH1021
Units and dimensions. System conversions. Material, momentum and energy balances. Steady state and transient heat transfer; insulation; heat exchangers. Solid and fluid rheology; viscosity; pumps; mixing.

FOOD4110
Food Process Engineering
Staff Contact: Dr R.H. Driscoll
S2 L2 T2
Prerequisite: FOOD4210

FOOD4320
Computer Applications
Staff Contact: Dr R.H. Driscoll
S2 L1 T1
Prerequisite: MATH2819
Introduction to VAX/VMS, VM/CMS, MSDOS and other control languages. The use of statistical, graphics and other program packages to solve problems in food science and technology.

FOOD4420
Food Packaging
Staff Contact: Dr R.H. Driscoll
S1 L2 T1
Pre or Corequisite: FOOD1310
Chemical and physical properties of packaging materials. Interaction between package and food, selection and evaluation of packaging materials and systems, design, printing, computers, modified atmosphere, smart films.

FOOD4430
Advanced Food Engineering A
Staff Contact: Dr R.H. Driscoll
C3 S2 L2 T1
Prerequisites: FOOD4210, FOOD4310
Extrusion of food products, membrane technology, refrigeration, chilling, freezing, thawing, tempering, cold room design, process control.

FOOD4440
Advanced Food Engineering B
Staff Contact: Dr R.H. Driscoll
C3 S2 L2 T1
Prerequisites: FOOD4210, FOOD4310
Mechanical and chemical separation, evaporation, distillation, psychrometry, drying, dryers, mass/energy balances, calculation of drying time, commercial equipment, current drying research.
Graduate Study

The School of Applied Bioscience conducts formal courses leading to the award of Master of Applied Science degrees in Biotechnology, Food Technology, Food Microbiology and Food Engineering and Graduate Diplomas in Biotechnology and Food Technology.

In addition, the School welcomes enquiries from graduates in Chemistry, Biochemistry, Microbiology, Applied Science, Chemical Engineering, Physiology, Nutrition and Agriculture who are interested in pursuing research in biotechnology or in food science and technology for the award of the degrees of Master of Science and Doctor of Philosophy.

The Head of School provides information on research scholarships, fellowships, grants-in-aid and School research activities. Graduates are advised to consult the Head of School or Departments before making a formal application for registration.

Course Outlines

Department of Biotechnology

5015
Biotechnology Graduate Diploma Course

Graduate Diploma GradDip

The graduate diploma course provides the opportunity for graduates with no previous tuition in biotechnology to undertake training in this discipline.

A degree in a science-based course is required for admission. If the degree course has not included a biology component, the candidate is required to undertake some basic biology training as a prerequisite or corequisite.

Under normal circumstances, students whose previous training has included a substantial component of biotechnology will not be admitted to the course.

The course comprises study of undergraduate and graduate formal subjects, plus extensive laboratory training in biotechnology.

The diploma is awarded after one year's full-time study, consisting of an average of 18 hours per week, or two years part-time study, consisting of an average of 9 hours per week. The program includes the listed obligatory subjects plus sufficient of the listed elective subjects to meet the hours of study required. The electives include subjects necessary for students without previous tuition in biochemistry and/or microbiology, as well as alternatives for those with previous tuition in these disciplines. The choice of electives in each individual case is subject to approval by the Head of School.

<table>
<thead>
<tr>
<th>Elective Subjects</th>
<th>HPW</th>
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</thead>
<tbody>
<tr>
<td>BIOT3031 Microbial Genetics</td>
<td>S1 6 S2 0</td>
<td></td>
</tr>
<tr>
<td>BIOT3061 Monoclonal Antibody and Genetic Techniques in Biotechnology</td>
<td>0 6</td>
<td></td>
</tr>
<tr>
<td>BIOT7100 Biological Principles</td>
<td>3 0</td>
<td></td>
</tr>
<tr>
<td>BIOT7110 Bioengineering Principles</td>
<td>3 0</td>
<td></td>
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<tr>
<td>BIOT8010 Graduate Seminars</td>
<td>2 2</td>
<td></td>
</tr>
<tr>
<td>MICR2011 Microbiology</td>
<td>0 6</td>
<td></td>
</tr>
</tbody>
</table>

Other suitable electives from the Department of Food Science and Technology and/or other Schools.

8042
Master of Applied Science (Biotechnology) Graduate Course

Master of Applied Science (Biotechnology) MAppSc(Biotech)

The Department offers a formal graduate course at the masters' level. The course includes advanced treatments of all areas of biotechnology. It is open to graduates with a four-year degree in biotechnology or a related discipline, or who have, in the opinion of the Higher Degree Committee, acquired equivalent qualifications or experience. Intending students are referred to Conditions for the Award of Graduate Degrees set out later in this handbook.

The course consists of lectures, tutorials, practical sessions, case history studies and a supervised project. The minimum period of registration before the award of the degree is two sessions for full-time students and four sessions for part-time students.

An acceptable course would be a program of subjects involving a minimum of 18 hours per week for two sessions full-time or a minimum of 9 hours per week for four sessions part-time. Course details are as follows:

<table>
<thead>
<tr>
<th>Compulsory Subjects</th>
<th>HPW</th>
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</thead>
<tbody>
<tr>
<td>BIOT3011 Biotechnology A</td>
<td>S1 6 S2 0</td>
<td></td>
</tr>
<tr>
<td>BIOT3021 Biotechnology B</td>
<td>0 6</td>
<td></td>
</tr>
<tr>
<td>BIOT5013 Practical Biotechnology</td>
<td>6 6</td>
<td></td>
</tr>
</tbody>
</table>
Elective components

Elective subjects, including some undergraduate subjects, may be selected from those offered by the School of Applied Bioscience, or from those offered by other Schools in the University subject to approval.

Each individual course must be approved by the Higher Degree Committee of the Faculty of Applied Science and would comprise:

1. A major strand of related material comprising approximately 75% of the total program, including a project comprising not less than 15% nor more than 50% of the program.
2. A minor strand of broader based material comprising up to 25% of the total program.
3. Undergraduate units may be included in one or both strands but may not exceed 25% of the non-project component.
4. At least 60% of the non-project component must be taken in the Department of Biotechnology unless otherwise approved by the Head of School. The remainder, subject to approval and availability, may be undertaken elsewhere in the University. Full details of all subjects are listed under Disciplines of the University in the Calendar.

Department of Food Science and Technology

The Department conducts formal courses leading to the award of the Master of Applied Science degree and of the Graduate Diploma in food technology.

Master of Applied Science Degree Courses

The MAppSc degree courses provide for a comprehensive study of theoretical and applied aspects of the science, technology and engineering of foods. The courses are elective in nature providing an opportunity for graduates to apply their basic skills in areas relevant to these fields of applied science in which the Department has developed special expertise. Intending candidates are invited to contact the Head of Department for advice and recommendation.

Graduate courses are available for Master of Applied Science degree programs in the following areas:

Food Technology Course 8030
Food Microbiology Course 8031
Food Engineering Course 8035

Entry qualifications

A four-year Bachelor degree, honours degree or equivalent (e.g. three-year degree plus relevant employment experience) is the minimum requirement for admission to the courses.

Study programs

Students are required to complete a program of study totalling 36 credits (1 credit equals 1 hour of class contact per week for one session) made up of compulsory subjects, a compulsory project (either 6 or 12 or 18 credits) and elective subjects. Students who have previously studied compulsory subjects or their equivalent may be granted an exemption by the Head of Department but the equivalent number of credits must be completed by taking other approved subjects. The degree will comprise one year of full-time study (normally two sessions of 18 credits each) or two years of part-time study (normally four sessions of 9 credits each), and would comprise:

1. A major strand of related material comprising approximately 75% of the total program, including a project comprising not less than 15% nor more than 50% of the program.
2. A minor strand of broader based material comprising up to 25% of the total program.
3. Undergraduate material may be included in one or both strands but may not exceed 25% of the non-project component.
4. At least 60% of the non-project component must be taken in the School of Applied Bioscience unless otherwise approved by the Head of Department. The remainder, subject to approval and availability, may be undertaken elsewhere in the University. Full details of all subjects are listed under Disciplines of the University in the Calendar.

8030
Food Technology Graduate Course

Master of Applied Science MAppSc

The MAppSc course in Food Technology is particularly relevant to graduates in Agriculture, Applied Science and Science with principal interests in chemistry, biochemistry, microbiology, physiology, nutrition and engineering. This is a formal course consisting of core components (including a project), and an elective component that allows reasonable flexibility and a choice of subjects in food science and technology based on the candidate's background, subject to the availability of staff and resources.
The course comprises:  

**Compulsory Subjects**  

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>FOOD1527</td>
<td>Principles of Food Preservation</td>
<td>6</td>
</tr>
<tr>
<td>FOOD1557</td>
<td>Food Technology Laboratory</td>
<td>6</td>
</tr>
<tr>
<td>FOOD1707</td>
<td>Seminar</td>
<td>2</td>
</tr>
</tbody>
</table>

**Compulsory Project**  

Either  

- FOOD1717 Major Research Project 18  
- FOOD1727 Research Project 12  
- FOOD1737 Minor Project 6

*These credits may be concentrated in one session.*

**Elective Subjects**  

Elective subjects making up the remainder of the credits, including undergraduate subjects, may be selected from those offered by the School of Applied Bioscience, or from those offered by other Schools in the University subject to approval by the Head of Department.

The work involved in the project must be embodied in a report and submitted in accordance with the requirements of the Faculty.

Depending on the candidate’s background, enrolment in some of the above subjects may be accompanied by enrolment in related undergraduate subjects as prerequisites or corequisites. A particular subject may not necessarily be conducted in any one year.

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8031  

**Food Microbiology Graduate Course**

**Master of Applied Science MAAppSc**

The MAAppSc course in Food Microbiology is a program of study designed for graduates in Food Science, Food Technology, Microbiology, Biochemistry, Biotechnology or related disciplines who have an interest in microorganisms associated with foods. The course provides advanced training in all aspects of food microbiology as well as fundamental aspects of food science and technology.

**Entry qualifications**

A four year Bachelor degree, honours degree or equivalent involving some basic training in microbiology and biochemistry is the minimum requirement for admission to the course.

The course comprises:

**Compulsory Subjects**  

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOOD2597</td>
<td>Food Microbiology Seminar</td>
<td>2</td>
</tr>
<tr>
<td>FOOD2517</td>
<td>Food Microbiology</td>
<td>4</td>
</tr>
<tr>
<td>FOOD2527</td>
<td>Microbiological Examination of Foods</td>
<td>6</td>
</tr>
<tr>
<td>FOOD2537</td>
<td>Microbiological Quality Assurance</td>
<td>2</td>
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</tbody>
</table>

**Compulsory Project**

Either  

- FOOD2617 Major Research Project in Food Microbiology 18  
- FOOD2607 Food Microbiology Research Project 12  
- FOOD2547 Food Microbiology Project 6

**Elective Subjects**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOOD1517</td>
<td>Chemistry, Biochemistry and Physics of Foods</td>
<td>3</td>
</tr>
<tr>
<td>FOOD1527</td>
<td>Principles of Food Preservation</td>
<td>6</td>
</tr>
<tr>
<td>FOOD2507</td>
<td>Introductory Microbiology</td>
<td>3</td>
</tr>
<tr>
<td>FOOD2557</td>
<td>Microbial Spoilage of Foods</td>
<td>1</td>
</tr>
<tr>
<td>FOOD2567</td>
<td>Foodborne Microorganisms of Public Health Significance</td>
<td>2</td>
</tr>
<tr>
<td>FOOD2577</td>
<td>Food and Beverage Fermentations</td>
<td>2</td>
</tr>
<tr>
<td>FOOD2587</td>
<td>Microorganisms as Food Processing Aids and Ingredients</td>
<td>1</td>
</tr>
</tbody>
</table>

or other subjects offered by the Departments of Food Science and Technology and of Biotechnology or other Schools subject to approval by the Head of Department.

*Credits may be concentrated in one session.*

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8035  

**Food Engineering Graduate Course**

**Master of Applied Science MAAppSc**

The MAAppSc course in Food Engineering is a formal course designed for graduates in Engineering or related disciplines and who have an interest in the processing of biological resources for human consumption. The formal components of the course provide professional training at an advanced level in food engineering and food science. The studies in food engineering are designed to strengthen and broaden the engineering background of candidates and emphasise the use of fundamental principles in solving problems associated with food processing. Problem solving skills in engineering are developed further in a research project devoted to an area of food engineering.

The course comprises:

**Compulsory Subjects**  

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOOD1707</td>
<td>Seminar</td>
<td>2</td>
</tr>
<tr>
<td>FOOD4557</td>
<td>Food Engineering Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>FOOD4567</td>
<td>Food Engineering Field Work</td>
<td>3</td>
</tr>
<tr>
<td>FOOD4587</td>
<td>Advanced Food Engineering A</td>
<td>4</td>
</tr>
<tr>
<td>FOOD4597</td>
<td>Advanced Food Engineering B</td>
<td>4</td>
</tr>
<tr>
<td>FOOD4607</td>
<td>Packaging and Production</td>
<td>4</td>
</tr>
</tbody>
</table>
Compulsory Project

Either
FOOD1717 Major Research Project 18
or
FOOD1727 Research Project 12
or
FOOD1737 Minor Project 6

* Credits may be concentrated in one session.

Elective components

The elective subjects making up the remainder of the credits, including undergraduate subjects, may be selected from those offered by the School of Applied Bioscience, or from those offered by other Schools in the University subject to approval by the Head of Department.

5020
Food Technology Graduate Diploma Course

Graduate Diploma GradDip

The Graduate Diploma course is designed to provide professional training at an advanced level for graduates in Science, Applied Science or Engineering who have not had previous training in Food Technology. Requirements are a first degree and, in some cases, the successful completion of assignments or examinations, as directed by the Head of Department.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

Units are offered separately subject to specified prerequisites as well as the restrictions on those units designed as bridging materials.

Department of Biotechnology

BIOT8010
Graduate Seminars
Staff Contact: Department Office
F T2

BIOT7010
Reading List in Biotechnology (Microbiology)
Staff Contact: Prof N Dunn
S1 or S2 T3

BIOT7020
Reading List in Biotechnology (Biochemistry)
Staff Contact: Prof N Dunn
S1 or S2 T3

BIOT5013
Practica! Biotechnology
Staff Contact: Department Office
F T6

Illustration, demonstration and operation of laboratoryscale and pilotscale equipment. Visits to appropriate industries. Experimental project or critical review.

BIOT7043
Biotechnology Project (Major)
Staff Contact: Department Office
F T8

An experimental or technical investigation or design project in the general field of biotechnology.
BIOT7051
Applied Genetics
Staff Contact: Prof N Dunn
S2 L2 T3
Isolation of commercially useful microorganisms. Mutagenesis and the isolation of mutants of the following types: auxotrophs; catabolic mutants; feedback inhibition and repression resistance; constitutive; catabolite repression resistance; resistance to antimicrobial agents and to viruses; extended enzyme substrate specificity; altered enzyme properties; changes in promoter and attenuator activity.

Techniques of genetic exchange: transformation; conjugation; transduction; cell fusion; sexual and parasexual cycles. The use of these techniques in strain construction.


BIOT7061
Peptide and Protein Technology
Staff Contact: Dr S Mahler
S2 L2 T3
Industrial scale production of enzymes, peptide hormones, antibodies including monoclonal antibodies, vaccines; regulation of synthesis by environmental control and genetic manipulation; recovery and downstream processing techniques; immobilization by entrapment and binding.

Applications of proteins in medical therapy and diagnosis and as analytical tools including ELISA and affinity chromatography: applications of enzymes in the food and beverage industries.

BIOT7071
Biochemical Engineering
Staff Contact: Prof P Gray
S2 L2 T3
Design of bioreactors; range of biocatalysts from free enzymes to immobilized cells; heat and mass transfer, scaleup, economic feasibility studies as applied to bioprocesses; design of equipment and facilities for sterile operation and to meet recDNA guidelines; downstream processing, design and operation; instrumentation and control; use of computerlinked systems; mathematical simulation.


BIOT7081
Environmental Biotechnology
Staff Contact: Dr J Madgwick
S1 L2 T3
Environmental Biotechnology examines the way microbes decompose chemically complex materials. Applications include the use of bacteria and fungi to detoxify wastes, converting them to usable substances. Prevention of biodeterioration of valuable materials is also an important area of study. Lectures cover biodegradation of minerals, metals, cellulosics, aromatics, hydrocarbons and wastewater treatment. Students present research reviews and conduct experimental projects.

BIOT7091
Applied Cellular Physiology
Staff Contact: Department Office
S1 L2 T3
Elemental and molecular composition of cells; formulation of growth media; stoichiometry of growth processes and product formation; metabolic regulation; stringent response; mechanisms of metabolite uptake and product release; maintenance energy; thermodynamics of cellular growth and activities. Effect of mutation on cellular physiology; recombinant DNA products. Fermentation processes: inoculum preparation, physiology of selected processes.

BIOT7100
Biological Principles
Staff Contact: Dr S Delaney
S1 L3

BIOT7110
Bioengineering Principles
Staff Contact: Department Office
S1 L3
A subject designed to provide an introductory course for students in the MAppSc Biotech program who have not previously undertaken any bioengineering studies.

Steady state and differential balances as a basis for quantification of complex real systems. Concepts in rate processes and kinetic analysis with application to biological systems. Experimental determination of rate data. Correlation of simple lumped rate processes and simultaneous distributed processes and the concepts involved in dimensionless numbers.

Laminar and turbulent flow. The structure of homogeneous and boundary layer turbulence flow in pipes and channels. Mixing theory. Process vessel reactor models.

Fluid viscosity, Newtonian and non-Newtonian fluids, convective and molecular transport processes. Heat and mass transport, film coefficients. Film, boundary layer, penetration and surface renewal theories.

Quantification of complex systems. Empirical and mechanistic models in biological systems.
A small experimental or design project, or an extensive literature review and analysis of a selected topic in biotechnology.

**Department of Food Science and Technology**

**FOOD1507**
Introductory Food Science  
*Staff Contact: Prof K.A. Buckle*  
C2 S1 L1 S2 T1  
An introduction to the history of food preservation and human nutrition. Current world food patterns, organizations and trade. Food development programs, regional and international agencies and activities. Parameters of food quality; food choice and social behaviour, food and society. Students present a seminar on aspects of food science in Session 2.

**FOOD1517**  
Chemistry, Biochemistry and Physics of Foods  
*Staff Contact: Prof K.A. Buckle*  
C3 S1 or S2 L2 T1  

**FOOD1527**
Principles of Food Preservation  
*Staff Contact: Prof K.A. Buckle*  
C6 S1 L3 T3  
Spoilage control by traditional and modern techniques. Technology of food preservation by heating, chilling and freezing, sun drying and dehydration, salt, sugar, acid, chemical preservatives, ionizing radiations, modified atmospheres. Chemical and microbial stability of foods. Packaging requirements for preserved foods. An integrated program of laboratory and pilot plant exercises designed to illustrate the principles and procedures presented in the lecture course.

**FOOD1537**
Plant Food Products  
*Staff Contact: Dr C.M.C. Yuen*  
C2 S1 L2  

**FOOD1547**
Animal Food Products  
*Staff Contact: Dr J.E. Paton*  
C3 S1 L3  
Nature and distribution of world animal food resources. *Meat*: muscle structure, function, slaughter, conversion of muscle to meat; chemical, biochemical factors in postmortem glycolysis; meat microbiology; chilling, freezing, curing, processing of meat and meat-derived products; processing equipment; meat marketing systems; nutritional and sensory properties of meats. *Milk and dairy products*: chemical, physical properties, microbiology of milk; technology of milk-derived products including cheese, fermented products, butter, frozen, chilled and dried milk-derived foods. *Marine products*: nature and distribution of world fishery resources; teleostean and elasmobranch species, spoilage mechanisms, quality assessment; preservation by chilling, freezing, salting, drying, smoking, marinating and fermentation; fish meal and fish protein concentrate. *Egg products*: structure and composition of the avian egg; changes during storage of whole eggs; egg quality assessment; functional properties of egg components; preservation of the intact egg; pulping, freezing and drying of whole egg pulp, yolk and albumen.

**FOOD1557**
Food Technology Laboratory  
*Staff Contact: Dr J.E. Paton*  
C6 S2 T6  
Prerequisite: FOOD1527, FOOD1537, FOOD1547 or their equivalent  
A program of laboratory and pilot plant exercises integrating elements of the chemical, physical, sensory and microbiological analysis of foods and the impact of processing on these factors. The program is designed to demonstrate the application of laboratory methods to food systems.

**FOOD1627**
Technology of Cereal Products  
*Staff Contact: Dr J. Arcot*  
C2 S2 L2  
Prerequisite: FOOD1537 or equivalent  
FOOD1637
Marine Products
Staff Contact: Prof K.A. Buckle
C2 S2 L2
Prerequisite: FOOD1547 or equivalent
Note/s: Not offered in 1994

FOOD1647
Food Additives and Toxicology
Staff Contact: A/Prof M. Wootton
C2 S1 L2
Functions, modes of action of food additives, consequences of use, ethical and legislative considerations. National, State and international attitudes and standards. Principles of toxicological testing, the evaluation of results.

FOOD1657
Postharvest Physiology and Handling of Fruit and Vegetables
Staff Contact: Dr C.M.C. Yuen
C6 S1 L1 T5
Pre or Corequisite: FOOD1537 or equivalent
Biochemistry and physiology of metabolism in fresh fruit and vegetables; respiration measurements as an index of metabolism, maturation and senescence; concept of climacteric and nondimacteric produce; physiological and metabolic changes occurring during ripening. Effect of temperature on metabolism; constraints of high and low temperatures; role of humidity control and water loss in quality maintenance; use of atmosphere control to delay senescence and ripening. Physiological disorders of stored produce; microorganisms of importance to postharvest tissue; physical and chemical methods of control; postharvest disinfection and quarantine measures. Examination of current commercial storage and marketing operations.

FOOD1667
Postharvest Storage of Foods
Staff Contact: Dr C.M.C. Yuen
C6 S1 L2 T4
Prerequisite: FOOD1557 or equivalent
Preharvest considerations, postharvest physiology and biochemistry, postharvest factors affecting quality, methods of storage and handling, marketing strategies for selected food commodities.

FOOD1707
Seminar
Staff Contact: Dr C.M.C. Yuen
C2 F T1
Students present material arising from literature and/or laboratory assignments and/or plant investigations in the food and related industries. Critical assessments are made of the results of research in food science and technology.

FOOD1717
Major Research Project
Staff Contact: Prof K.A. Buckle
C18 F T9
A detailed investigation of a selected topic in food science and technology including submission of a project report.

FOOD1727
Research Project
Staff Contact: Prof K.A. Buckle
C12 F T6
An investigation of an aspect of food science and technology and submission of a project report.

FOOD1737
Minor Project
Staff Contact: Prof K.A. Buckle
C6 F T3
A study of an aspect of food science and technology and submission of a project report.

FOOD1747
Special Topics in Food Science and Technology
Staff Contact: Prof K.A. Buckle
C6 S1 or S2 T6
An individually supervised program of investigation in specialised aspects of food science and technology not otherwise offered. Embraces a literature review, laboratory work and/or industrial liaison as may be appropriate. Available only to appropriately qualified students.

FOOD1757
Special Topics in Food Science and Technology
Staff Contact: Prof K.A. Buckle
C3 S1 or S2 T3
A similar but shorter investigation to that outlined in FOOD1747.

FOOD1767
Reading Assignment
Staff Contact: Prof K.A. Buckle
C1 SS T1
A reading assignment in an area supporting candidates’ major disciplines or commodity interests. Presentation of a seminar may be required.

FOOD2507
Introductory Microbiology
Staff Contact: A/Prof G.H. Fleet
C3 S1 L2 T2
Note/s: Not offered in 1994
This subject is designed as a prerequisite to FOOD2517 for students with very limited or no background in basic microbiology. It covers the fundamentals of microbial taxonomy, ecology, cytology and biochemistry and the basic technologies of microbial culture, isolation, enumeration and identification.

FOOD2517
Food Microbiology
Staff Contact: A/Prof G.H. Fleet
C4 S1 L2 T2
Prerequisite: FOOD2507 or other introductory microbiology subject
A lecture and laboratory program on the ecology, biochemistry, isolation, enumeration and identification of bacteria, yeasts, fungi and viruses associated with foods and beverages. Food spoilage: specific food/microorganism associations; taxonomy and biochemistry of major spoilage species; chemical and physical changes to food properties; control of spoilage of specific commodities. Foodborne microbial disease: foods as vectors of disease and food poisoning; statistics and epidemiology; ecology and taxonomy of foodborne pathogenic microorganisms; control and prevention by hygiene, microbiological standards and legislation. Food fermentation: microbial ecology and biochemistry of fermentations; fermentation of alcoholic beverages, bakery products, dairy products, meats, vegetables, cocoa beans, soy sauce; production of food ingredients and processing aids by fermentation. Microbiological examination of foods: sample preparation and sampling plans; sublethal injury; standard methods for determination of total plate counts, indicator organisms, foodborne pathogenic species, principal spoilage species. Microbiological quality assurance: specifications and standards; decision criteria; hazard analysis and critical control point (HACCP) concept; cleaning and sanitation.

FOOD2527
Microbiological Examination of Foods
Staff Contact: A/Prof G.H. Fleet
C6 S2 L2 T4
Prerequisite: FOOD2517 or equivalent


FOOD2537
Microbiological Quality Assurance
Staff Contact: Dr B.A. Munce
C2 S1 L1 T1
Prerequisite: FOOD2507 or equivalent
Corequisite: FOOD2527

A theoretical and practical consideration of the management of microbiological quality assurance. HACCP. Cleaning and sanitation. Microbiological specifications and regulations. Local and international approaches to obtaining safe food. Management and quality assurance in the microbiology laboratory.

FOOD2547
Food Microbiology Project
Staff Contact: A/Prof G.H. Fleet
C6 F T3
Prerequisite: FOOD2517

A study of an aspect of food microbiology and submission of a project report.

FOOD2557
Microbial Spoilage of Foods
Staff Contact: Dr B.A. Munce
C1 S2 L1
Prerequisite: FOOD2517

Consideration of: major microbial groups responsible for spoilage - yeasts, moulds, lactic acid bacteria, acetic acid bacteria, psychrotrophs, lipolytics, proteolytics. Specific commodity groups - meat, dairy and fish products, fruits, vegetables. Impact of processing technologies on food spoilage and extension of shelf-life; biochemical basis of spoilage defects, taints; predictive considerations.

FOOD2567
Foodborne Microorganisms of Public Health Significance
Staff Contact: Dr B.A. Munce
C2 S2 L2
Prerequisite: FOOD2517
Corequisite: FOOD2527

An advanced treatment of the ecology, epidemiology, properties, pathogenicity, methods of analysis, economic significance and control of pathogenic microorganisms in foods. Salmonella, Shigella, Escherichia coli, Vibrio sp., Staphylococcus aureus, Bacillus sp., Clostridium perfringens, Clostridium botulinum, Yersinia, Listeria, Campylobacter, Aeromonas, Klebsiella, viruses, fungi.

FOOD2577
Food and Beverage Fermentations
Staff Contact: A/Prof G.H. Fleet
C2 S2 L2
Prerequisite: FOOD2517

A detailed treatment of the microbial ecology, biochemistry, processing technology and quality parameters of fermented foods and beverages: cheese, yogurt, novel dairy products; meat sausages; bread, biscuit/cracker doughs; soybean products, soy sauce, tempe; traditional fermented products of Asia and Africa; vegetables; cocoa beans; alcoholic beverages, beer, wine, champagne, distilled spirit.

FOOD2587
Microorganisms as Food Processing Aids and Ingredients
Staff Contact: A/Prof G.H. Fleet
C1 S2 L1
Prerequisite: FOOD2517

This subject interfaces with biotechnology and considers the use of microorganisms as primary sources of processing aids and ingredients for food processing. The microbial production of vitamins, flavouring agents, amino acids, enzymes, pigments, thickening agents, fats and oils, modified proteins, organic acids. Use of microbial species as biocontrol agents to extend shelf-life, as agents to improve the nutritive and therapeutic value of foods, immobilized cell and cell reactor technologies for conducting food and beverage bioconversions.

FOOD2597
Food Microbiology Seminar
Staff Contact: Dr B.A. Munce
C2 S1 T1 S2 T1

Students present material arising from literature and/or laboratory assignments and/or plant investigations in the
area of food microbiology. Critical assessments are made of the results of research in food microbiology.

FOOD2607
Food Microbiology Research Project
Staff Contact: A/Prof G.H. Fleet
C12 F T6
An investigation of an aspect of food microbiology including a literature survey, experimental work and submission of a project thesis.

FOOD2617
Major Research Project in Food Microbiology
Staff Contact: A/Prof G.H. Fleet
C18 F T9
A detailed investigation of a selected topic in food microbiology involving a literature survey, experimental work and submission of a project thesis.

FOOD3507
Introductory Nutrition
Staff Contact: A/Prof H. Greenfield
S1 L2 T1
Role of nutrients in human structure and function. Effects of diet on growth and body size. Food habits, beliefs and choice; dietary patterns. Assessment of nutritional status; anthropometry, dietary intake studies, use of dietary recommendations, food groups, tables of food composition.

FOOD3517
Nutrition
Staff Contact: A/Prof H. Greenfield
S2 L2 T1
Prerequisite: FOOD3507 or equivalent
Nutritional needs of vulnerable groups: infants, pregnant and lactating women, the aged. Dietary intolerance, disorders related to the affluent diet including coronary heart disease, dental caries, diabetes, hypertension and cancer. Problems of undernutrition including protein, energy, mineral and vitamin deficiencies. Physiological and nutritional aspects of dietary fibre, alcohol and food intolerance. Measurement of nutrient intake using computer systems, on individual and group basis.

FOOD3527
Advanced Nutrition
Staff Contact: A/Prof H. Greenfield
S1 L1 T5
Prerequisite: FOOD3517 or equivalent

FOOD4507
Food Engineering Principles
Staff Contact: Ms J.L. Paterson
C3 S2 L2 T1
Prerequisite: First year mathematics and physics or equivalents
Units and dimensions; system conversions; material, energy and momentum balance; steady state and transient heat transfer; insulation; heat exchangers; solid and fluid rheology; viscosity; pumps; mixing.

FOOD4517
Unit Operations in Food Engineering
Staff Contact: Dr R.H. Driscoll
C4 S2 L2 T2
Prerequisite: FOOD4507 or equivalent
Refrigeration; freezing; chilling and thawing; evaporation; dehydration; extraction; distillation; extrusion; comminution; filtration and separation; process control; packaging.

FOOD4537
Computing in Food Science
Staff Contact: Dr R.H. Driscoll
C2 S2 L1 T1
Prerequisite: An introductory statistics subject or equivalent
Introduction to VAX/VMS, VM/CMS, MSDOS and other control languages; the use of statistical, graphics and other program packages to solve problems in food science and technology.

FOOD4557
Food Engineering Laboratory
Staff Contact: Ms J.L. Paterson
C3 S2 T3
Prerequisite: FOOD4587
Laboratory and pilot plant exercises illustrating the principles and procedures involved in food processing and food quality assessment.

FOOD4567
Food Engineering Field Work
Staff Contact: Dr R.H. Driscoll
C3 S1 T3
Inspection of food processing factories, agricultural and food research establishments and food producing areas.

FOOD4587
Advanced Food Engineering A
Staff Contact: Dr R.H. Driscoll
C4 S2 L3 T1
Corequisite: FOOD4517 or equivalent
Extrusion of food products, membrane technology, refrigeration, chilling, freezing, thawing, tempering, cold room design, process control, numerical techniques and modelling.

FOOD4597
Advanced Food Engineering B
Staff Contact: Dr R.H. Driscoll
C4 S2 L3 T1
Corequisite: FOOD4517 or equivalent
Mechanical and chemical separation, evaporation, distillation, psychrometry, drying, dryers, mass/energy balances, calculation of drying time, commercial equipment, current drying research.

FOOD4607
Packaging and Production
Staff Contact: Dr R.H. Driscoll
C4 S1 L3 T1
Chemical and physical properties of package materials; interaction between package and food; selection and evaluation of packaging materials and systems; package design criteria; printing; computers in packaging; modified atmospheres. Corrosion; scale-up; waste engineering; CIP systems; plant design.
School of Chemical Engineering and Industrial Chemistry

Head of School
Professor D.L. Trimm

Administrative Officer
Ms L.A. Woodcock

The School contains the Departments of Chemical Engineering and Industrial Chemistry which service undergraduate degree courses, and the Departments of Fuel Technology and Polymer Science and the Centre for Minerals Engineering* which offer professional electives in these degree courses. A professional elective in Biological Process Engineering is also available from the Department of Biotechnology.

Chemical engineering is the application of the principles of the physical sciences, together with the principles of economics and human relations, to fields in which matter undergoes a change in state, energy content or composition. The chemical engineer is generally responsible for the design, construction and operation of plant and equipment used in the chemical processing industries.

Fuel engineering is primarily concerned with the practical and economic applications of scientific knowledge and engineering experience to the production, processing and utilization of fuels and energy.

Industrial Chemistry is the discipline in which the scientific work of the research chemist is translated into the activities of the chemical industry. The thermodynamic feasibility of a reaction in inorganic or organic chemistry, the conditions under which the reaction might proceed, the kinetics of the reaction and the means whereby the reaction might be controlled to produce the desired product are the fundamentals of the course.

For the award of Honours in the Chemical Engineering and Industrial Chemistry degree courses, students need to have distinguished themselves in the formal work, in other assignments as directed by the Head of the School, and in the final year project, for which a thesis is required.

It is compulsory that, before completion of the course, students in Chemical Engineering must obtain a minimum of twelve weeks' professionally oriented or industrial experience.

It is compulsory that, before graduation, students in the full-time courses in Industrial Chemistry obtain a minimum of twelve weeks' professionally oriented or industrial experience. Students in the part-time courses in Industrial Chemistry must complete an approved program of industrial experience of not less than twelve months prior to the award of the degree.

*In conjunction with the School of Mines and School of Materials Science and Engineering.
Course Outlines

3040
Chemical Engineering - Full-time Course

Bachelor of Engineering
BE

This course extends over four years and students study full-time during the day for twenty-eight weeks of each year (excluding examination and recess periods).

Successful completion of the BE degree course is accepted by the Institution of Chemical Engineers, the Institution of Engineers, Australia, and Royal Australian Chemical Institute as sufficient academic qualification for corporate membership.

Various course patterns involving full-time or part-time study may be approved by the Head of School.

Year 1
CHEM1002 Chemistry 1 6 6
CHEN1020 Engineering 1 CE† 6 6
MATH1032 Mathematics 1 6 6
PHYS1002 Physics 1 6 6
General Education Subject Category A 0 2
Totalting 24 26

Year 2
CEIC2010 Instrumental Analysis 3 3
CEIC2020 Computing 1 2
CEIC2030 Applied Thermodynamics and Rate Processes 2.5 0
CEIC2040 Applied Electrochemical and Surface Processes 1.5 0
CHEM2828 Organic and Inorganic Chemistry (for Chemical Engineers) 4 0
CHEN2010 Material and Energy Balances 2 2
CHEN2020 Flow of Fluids 2 2
CHEN2030 Heat Transfer 0 3
CHEN2040 Mass Transfer Fundamentals 0 2
CHEN2050 Chemical Engineering Laboratory 1 0 2
ELEC0802 Electrical Power Engineering 0 3
INDC2050 Physical Process Laboratory 2 0
MATH2021 Mathematics 2 2
MATH2819 Statistics SA 2 2
General Education Subject/s 2 2
Totalting 24 25

Year 3
CEIC3010 Reaction Engineering S1 3
CHEN3010 Engineering Thermodynamics S2 4 0
CHEN3020 Numerical Methods S1 0 3
CHEN3030 Fluids 2 2 0
CHEN3040 Separation Processes 1 S1 2 2
CHEN3050 Particle Mechanics S2 0 3
CHEN3060 Process Plant Engineering 1 S1 4 4
CHEN3070 Process Control S2 0 2
CHEN3080 Chemical Engineering Laboratory 2 1.5 1.5
CHEN3090 Chemical Engineering Applications* S2 4 4
CIVL0616 Structures 3 0
MATH3021 Mathematics 2 2
General Education Subject 2 0
Totalting 24.5 24.5

(*Students taking the Fuel and Energy Engineering or Minerals Engineering Electives follow a modified program described below under 'Main Electives').

Year 4
APSE0002 Social Issues in Applied Science S2 0
CHEN4010 Separation Processes 2 S1 2 0
CHEN4020 Advanced Reaction Engineering* S1 2 0
CHEN4030 Safety and Environmental‖ S2 2 0
CHEN4040 Management 2 2
CHEN4050 Process Plant Operation* S1 0 3
CHEN4060 Process Plant Engineering 2 S2 4 0
CHEN4070 Process Dynamics and Control S1 3 2
CHEN4080 Design Project‖ S2 1 4
CHEN4090 Research Project* S2 2 10
CHEN4100 Professional Electives* S1 3 3
Totalting 23 24

(*Students taking the Fuel and Energy Engineering or Minerals Engineering Electives follow a modified Program described below under 'Main Electives').

†These subjects contribute towards satisfaction of the Category C General Education Requirement.

Main Electives

Fuel and Energy Engineering

The Department of Fuel Technology offers a coherent professional elective in Fuel and Energy Engineering designed for those students interested in the application of fuel and energy technologies in industry, commerce, government, education or research and development. The Department is the only one of its kind in Australia and has a long history of teaching and research in the fuels and energy area. The elective covers the broad areas of properties, constitution, processing, conversion and utilization of fuels. Topics include combustion science and engineering; radiation and flames; design and performance evaluation of fuel using plant such as furnaces, boilers and heat recovery appliances; coal and oil conversion.
processes; energy management and conservation; and progress in fuel science and fuel processing.

Students choosing this professional elective should take FUEL3010 Fuel and Energy Engineering 1 in Year 3 and FUEL4010 Fuel and Energy Engineering 2 and FUEL4090 Fuel and Energy Engineering Project in Year 4. Part-time students should take these subjects at equivalent stages of the part-time degree. (See BE Chemical Engineering 3040 Degree structure for the subjects that the Fuel and Energy Engineering courses replace).

This elective may qualify graduates for membership of the Australian Institute of Energy and the Institute of Energy UK.

**Minerals Engineering**

Jointly by the School of Chemical Engineering and Industrial Chemistry and the School of Mines, the Minerals elective is offered to students who wish to obtain a basic training in preparation for a career in the mineral industry. The elective covers the areas of secondary treatment of mineral sources, from physical mineral processing to pyrometallurgy and hydrometallurgy. Topics include engineering principles and current plant practices in comminution, beneficiation, extraction, purification, product recovery and other pyrometallurgical operations currently used in the coal, heavy minerals, iron and steel, nonferrous, base and precious metal industries. Progress in mineral science and technology, mineral plant design and process evaluation are also parts of the elective. Students choosing this elective should take the required subjects listed in the table below for Years 3 and 4 in lieu of the following subjects: CHEN3090 Chemical Engineering Applications, CHEN4090 Research Project, CHEN4020 Advanced Reaction Engineering, CHEN4030 Safety and Environmental, CHEN4050 Process Plant Operation, CHEN4100 Professional Electives. This elective may qualify graduates for membership of the Australian Institute of Mining and Metallurgy.

**Chemical Engineering - Part-time Course**

**Bachelor of Science (Technology) BSc(Tech)**

This course requires an approved program of twelve months of industrial training prior to the award of the degree.

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<th>Subject</th>
<th>HPW</th>
<th>S1</th>
<th>S2</th>
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<td>Year 3</td>
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<tr>
<td>MINE0130 Principles of Mining</td>
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<tr>
<td>MINE3101 Mineral Process Engineering</td>
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<td>2</td>
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<tr>
<td>MNP4010 Hydrometallurgical Processes</td>
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<tr>
<td>Year 4</td>
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<tr>
<td>GEOL5410 Mineralogy for Mineral Engineering</td>
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<td>MATS9650 Pyrometallurgical Processes</td>
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<td>MNP4020 Hydrometallurgy Practices</td>
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<tr>
<td>MNP4030 Hydrometallurgical Process Engineering</td>
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<td>2</td>
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<tr>
<td>MINE4101 Mineral Processing Practices</td>
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<td>0</td>
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<tr>
<td>MINE4401 Mine Waste Disposal &amp; the Environment</td>
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<tr>
<td>MINE4402 Mineral Engineering Project</td>
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**Stage 1**

- MATH1032 Mathematics 1 6 6
- PHYS1002 Physics 1 6 6
- Totalling 12 12

**Stage 2**

- CEIC1020 Engineering I CE 6 6
- CHEM1002 Chemistry 1 6 6
- General Studies subject 2 0
- Totalling 14 12

**Stage 3**

- CEIC2010 Instrumental Analysis 3 3
- CEIC2020 Computing 1 2
- CEIC2030 Applied Thermodynamics and Rate Processes 2.5 0
- CEIC2040 Applied Electrochemical and Surface Processes 1.5 0
- ELEC0802 Electrical Power Engineering 0 3
- INDC2050 Physical Processes Laboratory 2 0
- MATH1021 Mathematics 2 2
- MATH2819 Statistics SA 2 2
- Totalling 14 12

**Stage 4**

- CHEM2828 Organic and Inorganic Chemistry 4 0
- CHEN2010 Material and Energy Balances 2 2
- CHEN2020 Flow of Fluids 2 2
- CHEN2030 Heat Transfer 0 3
- CHEN2040 Mass Transfer Fundamentals 0 2
- CHEN2050 Chemical Engineering Laboratory I 1 2
- General Education Subject 2 2
- Totalling 11 13

**Stage 5**

- CHEN3010 Engineering Thermodynamics 4 0
- CHEN3020 Numerical Methods 0 3
- CHEN3050 Particle Mechanics 0 3
- CHEN3090 Chemical Engineering Applications 4 4
- CHEN4040 Management 2 2
- MATH3021 Mathematics 2 2
- Totalling 12 14

**Stage 6**

- CEIC3010 Reaction Engineering 0 3
- CHEN3030 Fluids II 2 0
- CHEN3040 Separation Process I 2 2
- CHEN3060 Process Plant Engineering I 4 4
- CHEN3070 Process Control 0 2
- CHEN3080 Chemical Engineering Laboratory II 1.5 1.5
- General Education Subject 2 0
- Totalling 11.5 12.5
### 3100 Industrial Chemistry - Full-time Course

**Bachelor of Science (BSc)**

Industrial Chemistry is a four-year professional (prescribed) science course that is concerned with the application of science and technology to the chemical industry.

Successful completion of the course is accepted by the Royal Australian Chemical Institute as sufficient academic qualification for full corporate membership.

Various course patterns involving full-time and part-time study may be approved by the Head of School.

<table>
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<tr>
<th>HPW</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
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<tbody>
<tr>
<td></td>
<td>CHEM1002 Chemistry 1</td>
<td>CEIC2010 Instrumental Analysis</td>
<td>CEIC3010 Reaction Engineering</td>
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<td>INDC1020 Engineering 1 IC</td>
<td>CEIC2020 Computing</td>
<td>INDC3010 Thermodynamics</td>
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<td>MATH1032 Mathematics 1</td>
<td>CEIC2030 Applied Thermodynamics and Rate Processes</td>
<td>INDC3010 Numerical Methods</td>
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<td>PHYS1002 Physics 1</td>
<td>CEIC2040 Applied Electrochemical and Surface Processes</td>
<td>INDC3011 Experimental Design</td>
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<td>Totalling 24</td>
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*These subjects contribute towards satisfaction of the Category C General Education requirement.*

### 3110 Industrial Chemistry - Part-time Course

**Bachelor of Science (Technology) (BSc (Tech))**

This course requires an approved program of 12 months of industrial training prior to the award of the degree.

<table>
<thead>
<tr>
<th>HPW</th>
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<tr>
<td></td>
<td>CHEM1002 Chemistry 1</td>
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<td>INDC1020 Engineering 1 IC</td>
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<td>MATH1032 Mathematics 1</td>
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<td>PHYS1002 Physics 1</td>
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<td>Totalling 24</td>
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</table>
### Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

Students are expected to possess a calculator having exponential capabilities (\( \ln x \) and \( \exp x \) or '\( x \) to the \( y \)'); however, more advanced calculators and personal computers, will be found useful. In examinations, students may be required to use calculators supplied by the University, so that no student will have an unfair advantage over another. Further information may be obtained from the Head of the School.

Students of both Chemical Engineering and Industrial Chemistry are expected to have a copy of Perry J. H. ed. Chemical Engineers' Handbook 6th ed. McGraw-Hill. This book is used extensively for most subjects and units. Certain subjects and units do not have specified textbooks and in these cases reference books are used or printed notes supplied.

### Chemical Engineering and Industrial Chemistry

#### CEIC2010
**Instrumental Analysis**

*Staff Contact: A/Prof M. Brungs*

**Prerequisites:** PHYS1002, CHEM1002, MATH1032, CHEN1020 or INDC1020


#### CEIC2020
**Computing**

*Staff Contact: Dr T. Pham*

**Prerequisites:** MATH1032, CHEM1002, PHYS1002, CHEN1020 or INDC1020

Computing for technical applications. Operating systems: VAX computers, the VMS operating system and the EDT editor. The FORTRAN language Elementary numerical methods; library subprograms; structures of program modules for technical calculations. The BASIC language.

#### CEIC2030
**Applied Thermodynamics and Rate Processes**

*Staff Contact: Dr R. Chaplin*

**Prerequisites:** PHYS1002, CHEM1002 or CHEM1102 and CHEM1201, MATH1032, CHEN1020 or INDC1020

General properties of solutions. Maximum conversion of reactants in batch and flow reactors. Reactor design and chemical kinetics. Reaction rates in industrial batch and flow reactors. The effect of temperature and concentration. The interaction of mass and heat transfer with chemical reaction rates. Laboratory kinetic measurements and their relevance to reactor design.

**CEIC2040**

Applied Electrochemical and Surface Processes
Staff Contact: Dr R. Chaplin
S1 L1.5
Prerequisites: PHYS1002, CHEM1102 and CHEM1201, MATH1032, CHEN1020 or INDC1020


**CEIC3010**

Reaction Engineering
Staff Contact: A/Prof N. Foster
S2 L2 T1
Prerequisites: CEIC2020, CEIC2030, CEIC2040, CHEN2010 or INDC2010, CHEN2020 or INDC2020, CHEN2030 or INDC2030


**CEIC4010**

Process Economics 1
Staff Contact: Dr T. Tran
S1 L1
Consists of the segment Process Economics CHEN3060 Process Plant Engineering 1

**CEIC4020**

Process Plant Economics 2
Staff Contact: Dr T. Tran
S2 L1
Consists of the segment Process Economics 2 from CHEN4060 Process Plant Engineering 2

**CEIC4200**

Industrial Experience
Staff Contact: Dr C. Dixon

Students in the four-year courses must obtain a minimum of twelve weeks professionally oriented or industrial experience prior to the award of the degree.

**CEIC4210**

Industrial Experience
Staff Contact: Dr C. Dixon

Students in the BSc (Tech) course in Industrial Chemistry must complete an approved program of industrial experience of not less than twelve months prior to the award of the degree.

**CHEN1010**

Introduction to Chemical Engineering
Staff Contact: Dr D. Wiley
F L1 T1

Introduction to the processing industry and chemical engineering practice. The role and responsibilities of the chemical engineer. Introduction to materials of construction for the processing industries. Application of process calculations in chemical process operations. Conventions in methods of analysis and measurement. The chemical equation and stoichiometry. Introduction to material balancing. Process calculations associated with gases, vapours and liquids.

**CHEN1020**

Engineering 1 CE
Staff Contact: Dr C. Dixon
S1 L2 T4 S2 L3 T3

This subject comprises CHEN1010 Introduction to Chemical Engineering, MECH0130 Engineering Drawing and Descriptive Geometry and MECH0330 Engineering Mechanics.

Each subject is described elsewhere in this handbook. Prospective students should note the following: It is not necessary to pass each of the three component subjects individually; however, for a student who does not pass all components separately the composite mark for the whole subject is not calculated by a simple averaging process. For a component subject in which a passing mark is not obtained, heavier weighting is applied; the lower the mark the heavier the weighting. The details of the calculation method are explained in the first week of the course. A student who is repeating the subject after failure must repeat all three components. No exemptions will be granted for components that were passed at an earlier attempt.

**CHEN2010**

Material and Energy Balances
Staff Contact: Dr E. Curry-Hyde
F L1 T1
Prerequisites: CHEM1020, CHEN1020, MATH1032, PHYS1002

### CHEN2020

**Flow of Fluids**

*Staff Contact: A/Prof J. Raper*

**F L1 T1**

**Prerequisites:** PHYS1002, CHEN1020, CHEM1002, MATH1032


### CHEN2030

**Heat Transfer**

*Staff Contact: Dr C. Jones*

**S2 L2 T1**

**Prerequisites:** PHYS1002, CHEN1020, CHEM1002, MATH1032


### CHEN2040

**Mass Transfer Fundamentals**

*Staff Contact: Dr A. Adesina*

**S2 L1 T1**

**Prerequisites:** PHYS1002, CHEM1002, CHEN1020, MATH1032

An introduction to the significance of mass transfer to the chemical engineer. Topics to be covered include: mechanisms of mass transfer, mass transfer driving forces, molecular diffusion, mass transfer models, phase equilibrium. Discussion of application of mass transfer in the chemical process industries.

### CHEN2051

**Chemical Engineering Laboratory I**

*Staff Contact: A/Prof N. Foster*

**S1 T3 S2 T2**

**Prerequisites:** PHYS1002, CHEM1002, CHEN1020, MATH1032

An introduction to laboratory work in chemical engineering including information retrieval techniques. Experiments designed to demonstrate physical processes in industrial situations.

### CHEN3010

**Engineering Thermodynamics**

*Staff Contact: Dr D. Wiley*

**S1 HPW4**

**Co or Prerequisites:** CEIC2030, CEIC2040, CHEN2010, CHEN2020


### CHEN3020

**Numerical Methods**

*Staff Contact: Dr H. Preisig*

**S1 L1 S2 L1 T1**

**Prerequisites:** CEIC2020, MATH2021, MATH2819


### CHEN3030

**Fluids 2**

*Staff Contact: Dr T. Pham*

**S1 HPW2**

**Prerequisites:** CEIC2020, CHEN2020, MATH2021


### CHEN3040

**Separation Processes**

*Staff Contact: A/Prof N. Foster*

**F L1 T1**

**Prerequisites:** CEIC2030, CEIC2040, CHEN2010, CHEN2020, CHEN2030, CHEN2040, CHEN2050


### CHEN3050

**Particle Mechanics**

*Staff Contact: A/Prof J. Raper*

**S2 L2 T1**

**Prerequisites:** CEIC2020, CHEN2020, MATH2021, MATH2819

Handling: Properties of granular solids and powders affecting storage and movement. Stockpiles, silos and hoppers: Feeders, conveyor belts and elevators.

CHEN3060
Process Plant Engineering 1
Staff Contact: Mr A. Papagelis
F L3 T1
Prerequisites: CHEN2010, CHEN2020, CHEN2030, ELEC0802, MATH2021

Processing Engineering I: All activities required from the conception of the idea to produce a product through to the finalisation of the process flow diagram including process selection and evaluation, process design, process simulation, process representation, process acquisition and licensing. Project Engineering I: Outline of scope of a process plant including plant location and layout, processing facilities and sites including utility system design, statutory regulations, facilities for storage, processing and transport of materials within the plant including design of piping systems. Process Equipment Design: Materials of construction. Procedures for the selection, design, specification and representation of process equipment. Pressure vessel and heat exchanger design. Engineering standards and procedures. Materials and Containment: The use and selection of metals, plastics, refractories, ceramics and glass in construction of chemical plants. Corrosion, strength of materials, use of codes and standards. Process Economics I: Capital and operating costs of a process plant. Fixed and variable costs. Break-even analysis. Cost estimation methods.

CHEN3070
Process Control
Staff Contact: Dr C. Dixon
S2 L2
Prerequisites: CEIC2010, CEIC2020, MATH2021


CHEN3080
Chemical Engineering Laboratory 2
Staff Contact: A/Prof N. Foster
FT1.5
Prerequisites: CHEM2828, CHEM2011, CEIC2010, CEIC2020, CHEN2010, CHEN2020, CHEN2030, CHEN2050, MATH2021, MATH2819

An integrated chemical engineering laboratory incorporating experiments in fluid flow, heat transfer, mass transfer, thermodynamics and kinetics, instrumentation and process dynamics and control. The objectives of this laboratory are: to demonstrate, reinforce and extend the principles of chemical engineering which are covered elsewhere in the course; to introduce various laboratory techniques which are used in the experimental investigation of chemical engineering problems; to develop an interest in experimentation, and to develop a proficiency in technical report writing.

CHEN3090
Chemical Engineering Applications
Staff Contact: Dr C. Dixon
F L2 T2
Prerequisites: CHEM2011, CEIC2020, CHEN2010, CHEN2020, CHEN2030, MATH2021, MATH2819

Application of chemical engineering principles to biochemical engineering, fuel engineering, solids handling, alumina and aluminium industries and polymer technology. Integrated problems illustrating skills in process analysis.

CHEN4010
Multicomponent Separation Processes
Staff Contact: Dr R. Amal
S1 L1 T1
Prerequisite: CHEN3010, CHEN3020, CHEN3040, MATH3021


CHEN4020
Advanced Reaction Engineering
Staff Contact: Dr A. Adesina
S1 L1 T1
Prerequisites: CEIC3010, CHEN3020, CHEN3030, CHEN3040, MATH3021


CHEN4030
Safety and Environmental Management
Staff Contact: Prof A. Fane
S1 L2
Prerequisites: CHEN3030, CHEN3040, CHEN3050, CHEN3060


CHEN4040
Management
Staff Contact: Prof A. Fane
F L2
Prerequisite: CHEN3060

This course will consider (i) the management of operating plant and (ii) project management of process plant projects. (i) Plant Management: company types, structure and organisation. Company financing and operation. Personnel management. Cost accounting. Company law, industrial relations and trade union practices. (ii) Project management: role and responsibilities of project management. Project organisation. Planning and

**CHEN4050**
Process Plant Operation

*Staff Contact: A/Prof R. Wood*

S2 L1 T2

*Prerequisite: All 3rd year subjects*

Practical studies of the operation of computer controlled chemical plant. Process diagnostics. Troubleshooting.

**CHEN4060**
Process Plant Engineering 2

*Staff Contact: Dr T. Tran*

S1 L2 T2

*Prerequisites: CHEN3060, CHEN3070*


**CHEN4070**
Process Dynamics and Control

*Staff Contact: Dr C. Dixon*

S1 L2 T1 S2 L1 T1

*Prerequisites: CEIC3010, CHEN3020, CHEN3070, MATH3021*

Common types of feedback controllers; translating control problems into block diagrams. Closed loop relationships and response; stability analysis for SISO systems; feedback controller tuning. Open and closed loop dynamic behaviour of systems of different order and how best to control these systems. Effect of dead time on control; introduction to dead time compensation. Introduction to cascade, feed forward and ratio control. Application of digital computers to real time control; interfacing computers with processes; distributed control systems; data acquisition and process monitoring; digital implementation of control algorithms. Introduction to multivariable control.

**CHEN4080**
Design Project

*Staff Contact: Prof A. Fane*

S1 T1 S2 T4

*Prerequisite: All 3rd year subjects*

This project will cover the engineering of a small process plant or part thereof requiring the application of material covered within the undergraduate course. The minimum requirements of this project are as specified by the relevant engineering institution's accreditation standards.

**CHEN4090**
Research Project

*Staff Contact: Dr D. Wiley*

S1 T2 S2 T10

*Prerequisites: All Year 3 subjects*

The experimental investigation of some aspect of chemical engineering.

**CHEN4100**

Professional Electives

*Staff Contact: Dr C. Dixon*

F L2 T1

*Prerequisite: All 3rd year subjects*

To be chosen from offerings in:

Advances in Computer-Aided Process Engineering; Polymer Engineering; Advanced Chemical Engineering Processes; Environmental Management for Chemical Engineers; Biochemical Engineering; Mineral Engineering and Advanced Process Control which will be offered by the relevant Schools or Departments.

**INDC1010**

Industrial Chemistry I

*Staff Contact: Dr D. Wiley*

F L1 T1

*Prerequisites: PHYS1002, MATH1032*

Introduction to the chemical industry. The role of the industrial chemist in society. The ethical responsibility of the industrial chemist. Introduction to materials for the chemical industry. Information retrieval. Communication skills. Factory visits.


**INDC1020**

Engineering I IC

*Staff Contact: Dr C. Dixon*

S1 L2 T4 S2 L3 T3

This subject is comprised of: INDC1010 Industrial Chemistry I, MECH0130 Engineering Drawing and Descriptive Geometry and MECH0330 Engineering Mechanics.

Each subject is described elsewhere in this handbook. Prospective students should note the following. It is not necessary to pass each of the three component subjects individually; however, for a student who does not pass all components separately the composite mark for the whole subject is not calculated by a simple averaging process. For a component subject in which a passing mark is not obtained, heavier weighting is applied; the lower the mark the heavier the weighting. The details of the calculation method are explained in the first week of the course. A student who is repeating the subject after failure must repeat all three components. No exemptions will be granted for components that were passed at an earlier attempt.

**INDC2010**

Mass and Energy Balances

*Staff Contact: A/Prof M. Brungs*

S1 L1 T1

*Prerequisites: CHEM1002, INDC1020, MATH1032, PHYS1002*

Application to varying composition systems; Mixing; Heat of solution; Enthalpy concentration diagrams. Reactions. Heats of formation and combustion.

Students not taking INDC1010 will be required to complete a 28 hour bridging course offered by the School early in Session 1.

**INDC2020**
**Introduction to Fluid Flow**
*Staff Contact: A/Prof J. Raper*
*S1 T2 S2 L1*
*Prerequisites: PHYS1002, MATH1032, CHEM1002, INDC1020*

Fundamental concepts of Fluids. Simplification of the Navier-Stokes Equation, continuity, Bernoulli's equation, momentum and energy equations. Flow in closed conduits, including laminar and turbulent flow, and losses due to friction. Measurement in Fluid Mechanics; viscosity, pressure, velocity, flowrate.

**INDC2030**
**Heat Transfer and Temperature Measurement**
*Staff Contact: Dr C. Jones*
*S2 L1 T1*
*Prerequisites: PHYS1002, MATH1032, CHEM1002, INDC1020*

The course will deal with conduction, convection and radiation. Conduction will cover Fourier's Law and the thermal resistance concept. Convection will deal with passage of fluid over a surface and the importance of the Reynolds number in calculating the convection heat transfer coefficient. Radiation will deal with blackbody radiation and Stefan's Law. Applications to industrial heat transfer equipment will be discussed. Temperature measurement devices and circuits. Pyrometry.

**INDC2050**
**Physical Processes Laboratory**
*Staff Contact: Dr P Crisp*
*S1 T2*
*Prerequisites: PHYS1002 (or CHEM1002), CHEM1102, CHEM1201, MATH1032, INDC1020*

An integrated industrial chemistry laboratory incorporating a series of experiments designed to demonstrate the principles of physical processes and instrumentation in industrial situations.

**INDC3010**
**Thermodynamics**
*Staff Contact: Dr D. Wiley*
*S1 L2 T1*
*Co or Prerequisites: CHEM2011, INDC2010*

Review of first law of thermodynamics; thermochemistry; second law of thermodynamics. Auxiliary functions and conditions of equilibrium. Thermodynamic properties of fluids; thermodynamic properties of homogeneous mixtures. Chemical reaction equilibria; calculation of equilibrium compositions for single reactions. Phase equilibria; the phase rule, equilibrium.

**INDC3021**
**Numerical Methods**
*Staff Contact: Dr H. Preisig*
*S2 L1 T1*
*Prerequisite: CEIC2020*


**INDC3031**
**Experimental Design**
*Staff Contact: Dr R. Chaplin*
*S1 L2 S2 T1*
*Prerequisite: MATH2819*


**INDC3041**
**Corrosion In the Chemical Industry**
*Staff Contact: A/Prof M. Brungs*
*S2 L2 T1*
*Prerequisite: CHEM2011*


**INDC3050**
**Chemistry of High Temperature Materials**
*Staff Contact: Prof M. Skyllas-Kazacos*
*S2 L2*
*Prerequisite: CHEM2011*

Chemical aspects of high temperature materials; thermodynamics and kinetics of reactions in the solid state; phase equilibria in condensed systems; gas-solid and liquid-solid reactions.

**INDC3060**
**Unit Operations**
*Staff Contact: Mr A. Papagelis*
*S1 L2*
*Prerequisites: INDC2010, CHEM2011*

Selected aspects of unit operations for industrial chemistry students such as distillation, liquid-liquid extraction, gas absorption, filtration evaporation and crystallization.

**INDC3070**
**Instrumentation and Process Control 1**
*Staff Contact: Dr C. Dixon*
*S2 L2 T1*
*Prerequisites: MATH2021, CEIC2010, CEIC2020, CHEM2041*

Analog Computation: theory and application of basic analog computing elements; magnitude and time scaling; solution of linear differential equations. Instrumentation: theory and application of transducers and transmitters for measurement of process variables. Process Dynamics: behaviour of linear, lumped parameter dynamics systems; first, second and higher order and integrating systems. Process Control: closed loop, block diagrams, controllers and controller tuning.
INDC3080
Instrumental Analysis 2  
Staff Contact: Dr P. Crisp  
S1 L2 T2  
Prerequisite: CEIC2010  
Theory and application of advanced instrumental techniques including: high performance liquid chromatography, infra-red spectroscopy, particle size analysis, surface area analysis, thermal analysis (TGA, DSC/DTA, DMA), ion chromatography, capillary gas chromatography.

INDC3090  
Chemistry of Industrial Processes  
Staff Contact: Dr T. Davis  
F L1 T2  
Prerequisite: CHEM2011  
Coor prerequisites: CHEM2021, CHEM2031  
The production of inorganic industrial chemicals from the standpoint of the application of the basic principles of inorganic and physical chemistry (acid industries, alkali industries, industrial gases electric furnace products, superphosphates, aluminum and glass); a study of some sections of the organic industrial chemical industry cellulose, industrial alcohols, formaldehyde, phenol, urea, phenolic and urea resins, acetic acid, polymers based on ethylene and acetylene, elastomers. Students are required to attend factory inspections at local and country centres as required. Laboratory: A small research project designed to illustrate practical applications of the principles of Industrial Chemistry.

INDC4010  
Applied Thermodynamics  
Staff Contact: Dr R. Chaplin  
S1 L1 T1  
Prerequisites: INDC3010, INDC3050  
Calculation of thermodynamic properties for non-ideal liquid and solid solutions. Development of statistical models for real solutions of industrial importance. Thermodynamics of interfaces. Phase equilibria in binary and ternary systems. A study of chemical equilibria in multicomponents, polyphase systems including appropriate computational methods.

INDC4020  
Applied Kinetics  
Staff Contact: Prof D. Trimm  
S1 L1 T1  
Prerequisites: INDC3020, CEIC3010  
Adsorption theory, kinetics of catalytic and noncatalytic fluid-solid reactions, rates of surface reaction, kinetics of heterogenous reactions affected by diffusion, catalyst characterization.

INDC4040  
Management  
Staff Contact: A/Prof M. Brungs  
S2 L2  
A series of lectures designed to introduce the students to appropriate management techniques. Topics will include: business strategies, leadership total quality management, safety management.

INDC4070  
Laboratory Automation Science  
Staff Contact: Dr H. Preisig  
S1 L1.5 T2.5  
Prerequisite: INDC3070  
The application of computers, e.g. microcomputers, to real-time data acquisition and process control in chemical laboratories and selected processes of interest to industrial chemists. Introduction to real-time digital operations and data manipulation. Organization of a process control computer. Hardware considerations. The process computer interface. Sequential and programmable logic control of batch processes. Data acquisition and process monitoring techniques. Digital process control PID controller tuning. Graphics in process monitoring and control. Direct Digital Control.

INDC4080  
Seminar  
Staff Contact: A/Prof R. Burford  
F T2  
Students are required to deliver two lecturettes on selected topics, one related to some aspect of chemical technology, and the other to their research project. The intention is to develop skill in oral expression, as well as ability in critical evaluation and logical presentation. Opportunity is taken, where appropriate, to arrange for guest lecturers.

INDC4090  
Project (Industrial Chemistry)  
Staff Contact: A/Prof R. Burford  
S1 T8 S2 T16  
An experimental or technical investigation related to some aspect of industrial chemistry. Prerequisites and/or corequisites will be determined depending on the nature of the project.

INDC4100  
Industrial Electrochemistry  
Staff Contact: Prof M. Skyllas-Kazacos  
S1 or S2 L2  
Prerequisites: INDC3090, INDC3020  
Fundamentals of electrodes, the ButlerVolmer equation, current/potential laws in relationship to reaction mechanism. Electrocalysis, gas evolution and co-deposition. Technological aspects of electrochemistry; energy conversion systems, storage systems and plating. Industrial processes, cell design and side reactions, gas bubble effect, current distribution and mass transfer effects. Developments in electrode technology, diaphragms and cell construction.

INDC4110  
Water Chemistry  
Staff Contact: A/Prof M. Brungs  
C3 S1 or S2 L2  
Prerequisite: CEIC2010  
Indicators of the Industrial Environment
Staff Contact: Dr P. Crisp
S1 L2 T1
Prerequisites: CHEM1101, CHEM1201


Centre for Minerals Engineering

MINP4010
Hydrometallurgical Processes
Staff Contact: Dr T. Tran
S1 L2

Application of principles of aqueous thermodynamics, electrochemistry, and electrochemical kinetics to hydrometallurgical processes; leaching of metals, minerals and concentrates, solution purification, precipitation, and other separation processes, ion-exchange and liquid-liquid extraction, electro-winning and electro-refining. Emphasis is on processes currently used in the Australian mineral industry.

MINP4020
Hydrometallurgy Practices
Staff Contact: Dr T. Tran
S1 L1 T2

A critical analysis of recent industrial and research development in hydrometallurgy, problems and methods available for research and development. Development of hydrometallurgical process flowsheets, elements of pre-feasibility studies. Selected laboratory exercises in an attempt to develop investigational skills for process development.

MINP4030
Hydrometallurgical Process Engineering
Staff Contact: Dr T. Tran
S2 L2

Thermodynamic and kinetic principles in extraction, precipitation, adsorption. Thermodynamics and kinetics of electrochemical processes: cementation, hydrogen reduction, electrolysis. Design of reactors for hydrometallurgical and electrometallurgical processes.

Servicing Subjects

These are subjects taught within courses offered by other faculties.

CEIC0010
Mass Transfer and Material Balances
Staff Contact: A/Prof. M. Brungs
F L1 T1
Prerequisites: CHEM1101, CHEM1201, CIVL2505


CEIC0020
Fluid/Solid Separation
Staff Contact: A/Prof. N. Foster
SS L1.5 T.5


CEIC0030
Environmental Protection in the Process Industries
Staff Contact: Dr P. Crisp
SS L3 T3
Prerequisites: CEIC0010, INDC3070 INDC4120

Selection of 3 topics from:

Environmental Pollutants

The characteristics of pollutants in air and water. Consequences of pollution by aqueous, gaseous and solid wastes; case histories. Standards and regulations; legislative aspects. Measurement, analysis and sampling - modern techniques of environmental chemical analysis.

Pollution Control Techniques


Water Pollution Control Engineering


Air Pollution Control


Laboratory for Environmental Analysis

14 hour laboratory unit developing techniques in modern environmental analysis.

Advanced Environmental Protection

This comprises a series of elective strands which build upon the core subject as follows:

1. Advanced treatment methods (water)
2. Advanced treatment methods (air)
3. Hazardous wastes
4. Computer-aided risk assessment
5. Advanced laboratory
6. Occupational Health Laboratory

CEIC4070
Laboratory Automation for Ceramic Engineers
Staff Contact: Dr H. Presig
S1 L1 T1
Application of microprocessors to laboratory automation. Basics of computing hardware and process interface hardware (A/D, D/A conversion, digital I/O etc.) Elements of real-time computing and software associated with the process interface. Real-time data acquisition, signal processing, discrete and sequential control of selected relevant example processes.

POLY0010
Polymer Materials
Staff Contact: A/Prof. R. Burford
S1 2 S2 4
The structure and synthesis of commercially important polymers including thermoplastics, fibres, rubbers and composites. The effect of chemical and molecular structure upon properties. Degradation. Mechanical properties including time dependent behaviour. Fabrication processes. Polymer selection for various applications.

Department of Fuel Technology

FUEL0010
Fuel Engineering (Mining and Mineral Processing Engineers)
Staff Contact: A/Prof. G. Sergeant
F L2 T1

FUEL0020
Fuels and Energy
Staff Contact: A/Prof. G. Sergeant
S2 L3 T1
A servicing subject for students in Electrical Engineering which covers the topics, sources and properties of fuels and energy, energy use patterns, principles of combustion, combustion calculations, the technology of boilers and other fuel plant, thermodynamic cycles, new and emerging energy technologies, including solar, wind and nuclear energy.

FUEL0030
Fuel Science for Industrial Chemists
Staff Contact: A/Prof G. Sergeant
S1 or S2 L2
Combustion science, mechanisms of major oxidation reactions, flames, mechanism of formation of carbon, NOx and SOx. Measurements of gas flow, gas composition, temperature in flames and furnaces. H-t relationships and their application.

FUEL0040
Fuel Engineering for Ceramic Engineers
Staff Contact: A/Prof G. Sergeant
F L1
An introduction to combustion technology, combustion calculations, burner design, furnace, kiln and boiler thermal design.

FUEL0050
Fuel and Energy Engineering for Process Metallurgy
Staff Contact: A/Prof G. Sergeant
S1 L1 S2 L2
An introduction to combustion technology, fuel plant technology and fuel processing.

FUEL3010
Fuel and Energy Engineering 1
Staff Contact: A/Prof G. Sergeant
F L3 T1
Sources, properties and classification of fuels and energy sources. Introduction to combustion engineering and science, the thermal design of furnaces, boilers and other fuel using plant, radiation. Basic principles of fuel processing, oil refining, gasification, liquefaction, carbonisation etc. Laboratory work on the properties of petroleum products, coal and gaseous fuels.

FUEL4010
Fuel and Energy Engineering 2
Staff Contact: A/Prof G. Sergeant
S1 L5 T4 S2 L2 T2
Combustion engineering. Furnace and fuel plant design. Energy management. Technologies for the efficient use of fuel. Properties and evaluation of fuels for their application. Laboratory work on burners, furnaces, combustion, efficiency, etc.

FUEL4090
Fuel and Energy Research Project
Staff Contact: A/Prof G. Sergeant
F T6
Investigation of some aspect of fuel engineering.

Department of Polymer Science

POLY3010
Polymer Science
Staff Contact: A/Prof R. Burford
S1 L2 S2 Lab.4
Prerequisites: CHEM2011, CHEM2021, MATH2021, MATH2819
Co or Prerequisites: INDC3090
Selected topics from basic texts and the original literature covering polymer analysis: physics of glassy polymers, viscoelasticity, polymer rheology, polymer morphology fracture and environmental stress cracking, rubber elasticity, anionic cationic and Ziegler-Natta catalysis in polymer chemistry, emulsion polymerization, silicon polymers and polymers for high temperature service.

Graduate Study

Course Outlines

Formal courses in the School of Chemical Engineering and Industrial Chemistry lead to the award of the Master of Applied Science or the Graduate Diploma.

Master of Applied Science Degree Courses

The MAppSc degree courses involve a project which must integrate and apply the principles treated in the course. It may take the form of a design feasibility study or an experimental investigation. Evidence of initiative and of a high level of ability and understanding is required in the student’s approach, and the results must be embodied in a report and submitted in accordance with the University’s requirements.

The following graduate courses are available to Master of Applied Science degree course candidates. Candidates may specialize in the following areas:

Chemical Engineering and Industrial Chemistry Course 8015
Fuel Technology Course 8060

The MAppSc degree courses provide for a comprehensive study of theoretical and practical aspects of many advanced topics. The courses are formal and elective in nature and provide an opportunity for graduates to apply their basic skills in fields in which the School has developed special expertise.

The courses specializing in Chemical Engineering and Industrial Chemistry, Fuel Technology and Petroleum Engineering are primarily intended for graduates in Applied Science, Engineering, or Science with principal interests in Chemistry, Mathematics and/or Physics. They are designed to allow the maximum flexibility consistent with the standing of the award.

Intending candidates are invited to submit proposed study programs to the Head of the School for advice and recommendation. Each individual course must be approved by the Higher Degree Committee of the Faculty of Applied Science. An acceptable course would be a program of formal study aggregating approximately 18 hours weekly for two sessions full-time or 9 hours weekly for four sessions part-time, and which could comprise:

1. A major strand of course material making up 75% of the total program. This includes a project constituting not less than 15% and not more than 30% of the program;
2. A minor strand of broader-based supporting material making up to 25% of the total program; and
3. Undergraduate material, which may be included in one or both strands but may not exceed 25% of the total program.

Approximately 60% of the program (including the project) must be undertaken in the School of Chemical Engineering and Industrial Chemistry. The remainder, subject to approval and availability, may be undertaken in other Schools within the University. Full details of all subjects are listed under Disciplines of the University in the Calendar. Courses will be run in any year only if sufficient applications are received. A minimum number of 5 registrations is usually required.

8015
Chemical Engineering and Industrial Chemistry Graduate Course

Master of Applied Science MAppSc

This course is designed to allow students to select areas of specialization appropriate to their needs. The areas of specialization include Industrial Chemistry, Chemical Engineering and Industrial Pollution Control. Students are asked to consult the area supervisors in the School to
develop a program of study which complies with regulations for the Master of Applied Science degree. Students may undertake a Major Project (CEIC5000) amounting to six hours per week for a year or take a Minor Project (CEIC5010) of three hours per week for a year and select an extra elective subject.

8060 Fuel Technology Graduate Course

Master of Applied Science MAppSc

This is a formal course leading to the award of the degree of Master of Applied Science. It is a two-year part-time course designed to provide professional training and specialization in fuel science or fuel and energy engineering for graduates in science, applied science or engineering who have not had substantial previous formal education in these subjects. The course may be offered over 1 year full time with a sufficiently high enrolment.

The course is based on the general formula for a MAppSc degree program, whereby the subject FUEL3010 can comprise the undergraduate component, the project (30% or 15% of the program) is CEIC5000 or CEIC5010 and the remainder of the hours can be taken from the units offered in the FUEL58.. and FUEL59.. series of subjects. There are also compulsory seminar and laboratory practice subjects.

The course allows reasonable flexibility with a choice of subjects, and units within subjects, subject to the availability of staff. Provision is made for subjects outside those offered by the Department to be incorporated in the program at either graduate or undergraduate level.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

Graduate subjects will only be offered if class numbers exceed 5. Some subjects will only be offered every alternate year. Contact School for further details.

CEIC5630 Industrial Water and Wastewater Engineering
Staff Contact: Prof A.G. Fane
C3 S2 L3

Environmental consequences of water pollution. Water quality criteria and regulations related to industrial use and disposal. Water sources and requirements of industry. Theoretical and practical aspects of treatment methods, including screening, sedimentation, oil separation, coagulation and flocculation, filtration, biological treatment, adsorption, ion exchange, membrane processes. Strategies for industry including waste surveys, prevention at source, correction before discharge water reuse. Economic aspects. Seminars. Factory visits/laboratory.

CEIC5700 Process Principles
Staff Contact: School Office


CEIC5810 Advanced Process Dynamics
Staff Contact: School Office


CEIC5820 Process Optimization
Staff Contact: School Office

Multivariable analytical and numerical optimization in free and constrained parameter space. Optimization of functions of a continuous variable. Dynamic programming. Applications of these techniques to specific chemical engineering problems.

CEIC5840 System Simulation and Control
Staff Contact: School Office

This is a participatory course in which case studies, discussion of recent papers, development of digital simulation programs and analog computer laboratory work play an important part.

Topics are selected from the following areas:

Unit 1 System Simulation
Numerical methods for digital simulation; programming languages and packages for system modelling of distributed parameter systems; use of analog computers in systems simulation. Application of these techniques to the study of process plant and equipment, environmental systems, and similar areas.

Unit 2 Advanced Process Control
System identification and parameter estimation; control of multiloop systems; non-linear systems; digital control and data logging, sequencing control.

CEIC5850 Interphase Mass Transfer
Staff Contact: School Office

Advanced theories of mass transfer. The effect of interfacial instability and methods for predicting its presence.
Theoretical prediction of mass transfer in dispersed systems. Multicomponent mass transfer.

CEIC5860 Fluid Particle Interactions
Staff Contact: School Office


CEIC5890 Graduate Colloquia
Staff Contact: School Office

Colloquia on research developments in the School of Chemical Engineering and Industrial Chemistry. Students are required to participate actively in the colloquia and give at least one dissertation based on their own investigations.

CEIC5900 Specialist Lectures
Staff Contact: School Office

CEIC5910 Advanced Thermodynamics
Staff Contact: School Office


CEIC5920 Computeraided Design
Staff Contact: School Office

A workshop type of course with considerable time devoted to discussion, seminars, writing and running of programs. Programming: methods, conventions, and standards; program design, flow-charting, co-ordination and documentation. Design: individual plant units and components, flowsheets, optimization and economic analysis. Physical property estimation. Simulation: continuous change and discrete change systems.

CEIC5930 Safety in Laboratories
Staff Contact: Dr R. Chaplin

S1


INDC5310 Catalysts and Applied Reaction Kinetics
Staff Contact: School Office

S1 or S2 L2 T4

Methods of catalyst preparation and characterization; adsorption theories; general mechanisms for gas-phase reactions catalyzed by solids; poisoning and catalyst decay; effectiveness factors; techniques in catalytic research; special topics in reaction kinetics including gas-solid non-catalytic reactions, polymer kinetics, electrochemical reaction kinetics and electrocatalysis; industrial catalytic processes; application of statistical methods to the solution of complex chemical data.

INDC5500 Instrumental Analysis for Industry
Staff Contact: School Office

F L1 T2

Role of analysis in process optimization. Accuracies of analytical methods compared to needs for equality control. Frequency of analysis in relationship to control and analytical costs. Importance of speed of analysis for information feedback. Case studies for selected processes in relation to selecting the analytical method.

INDC5610 Electrochemical Techniques for Control and Analysis
Staff Contact: School Office

S1 or S2 L2 T4

Indepth study of selected electroanalytical methods with respect to theoretical principles, instrumentation and practical utilization. The importance of adsorption and reaction mechanism on accuracies and application. Steady state and rapid scan voltammetry, stripping voltammetry, chronopotentiometry, chronocoulometry, classical coulometry and potentiometry. Instrument design and modification for specific needs.

Department of Fuel Technology

One Session Unit (SU) is equal to 1 hour per week for session of 14 weeks.

FUEL5800 Fuel Seminar
Staff Contact: A/Prof G. Sergeant

1 (SU) to be given in Session 2, compulsory in MAppSc degree course in Fuel Engineering. Content bias to choice of subjects.

FUEL5820 Fuel Constitution
Staff Contact: A/Prof G. Sergeant

Unit 1 - 1 (SU) Coal constitution and pyrolytic behaviour.
Unit 2 - 1 (SU) Constitution and classification of oils.
Unit 3 - 2 (SU) Advanced fuel constitution.

FUEL5830 Fuel Processing
Staff Contact: A/Prof G. Sergeant

Unit 1 - 2 (SU) Carbonization and gasification processes.
Unit 2 - 1 (SU) Liquid fuels from coals.
Unit 3 - 1 (SU) Chemicals from coals.
FUEL5840
Fuel Plant Engineering
Staff Contact: A/Prof G. Sergeant
Unit 1 - 1 (SU) Furnace design and heat recovery.
Unit 2 - 1 (SU) Process heat transfer and efficient use of steam.
Unit 3 - 2 (SU) Furnaces and boiler control system.
Unit 4 - 2 (SU) Fuel plant heat transfer.

FUEL5850
Combustion and Energy Systems
Staff Contact: A/Prof G. Sergeant
Unit 1 - 1 (SU) Combustion technology.
Unit 2 - 1 (SU) Fuel impurities, removal of and deposits from.
Unit 3 - 1 (SU) Efficiency in energy utilization.
Unit 4 - 1 (SU) Combined cycles and integrated systems.

FUEL5870
Fuel Technology Practice
Staff Contact: School Office
Compulsory in MAppSc (Fuel) (4 SU). Content bias towards choice of G subjects.

FUEL5880
Unit Operations in Wastewater, Sludge and Solid Waste Management
Staff Contact: A/Prof G. Sergeant
C3

FUEL5881
Unit Operations in Wastewater, Sludge and Solid Waste Management
Staff Contact: A/Prof G. Sergeant
C3
Syllabus as for FUEL5880. FUEL5881 is for external students in waste management courses.

FUEL5910
Atmospheric Pollution and Control (Theory)
Staff Contact: A/Prof G. Sergeant
C3 S1 or S2 L3
Causes, properties, dispersion, measurement and monitoring control and legislation of air pollution in ambient and industrial environments.

FUEL5911
Atmospheric Pollution and Control (Theory)
Staff Contact: A/Prof G. Sergeant
S1 or S2 L3
Note/s: For external students
Causes, properties, dispersion, measurement and monitoring, control and legislation of air pollution in ambient and industrial environments.

CEIC5000
Major Project
Staff Contact: School Office
A substantial project on some aspects of chemical engineering, industrial chemistry, polymer science, fuel technology or biological process engineering.

CEIC5010
Minor Project
Staff Contact: School Office
A minor investigation on some aspect of chemical engineering, industrial chemistry, polymer science, fuel technology or biological process engineering.

Department of Polymer Science

CEIC5000
Major Project
Staff Contact: School Office
A substantial project on some aspects of chemical engineering, industrial chemistry, polymer science, fuel technology or biological process engineering.

CEIC5010
Minor Project
Staff Contact: School Office
A minor investigation on some aspect of chemical engineering, industrial chemistry, polymer science, fuel technology or biological process engineering.

POLY5000
Polymer Science
Staff Contact: A/Prof R. Burford
F L3 T3
Polymer Processes: Classification of polymers, methods of polymerization; bulk, solution, emulsion, suspension, high pressure; processes; step growth, chain growth; the chemistry and applications of polymer systems including polyesters, polyamides, phenolic condensation resins, vinyl polymers, synthetic elastomers. Natural polymers. Mechanism and Kinetics: Step growth polymerization, kinetics, structure effects; chain growth polymerization. Free radical polymerization, chemistry and properties of free radicals and initiators; kinetics of propagation and termination reactions; co-polymerization; monomer radical structure and reactivity. Cationic and anionic polymerization; stereoregular polymers. Polymer Characterization: Molecular weight; averages and distributions; thermodynamics of polymer solutions; theta temperature; fractionation methods; measurement of number-average molecular weight and weight-average molecular weight. Polymer Physics: Principles of operation of conventional polymer processing equipment; safety procedures; polymer compound design; stress strain behaviour of polymers in tension, compression, shear and flexure; elementary rheological behaviour of polymers; rubber elasticity; thermal characteristics of polymers.

POLY5100
Analytical Characterization of Polymers
Staff Contact: A/Prof R. Burford
S1 or S2 L3 T3
Composition of formulated polymeric material. Group reactions, specific and colour reactions. Instrumental characterization of polymers, and co-polymers and
associated additives, eg plasticizers, anti-oxidants, etc by UV and IR spectrophotometry and pyrolysis gas chromatography. Analysis of films by transmission and reflectance spectrophotometric methods. Thermal analysis.

**POLY5300**

*Polymer Engineering*

*Staff Contact: A/Prof R. Burford*

*S1 or S2 L4 T2*


**POLY5400**

*Polymer Physics*

*Staff Contact: A/Prof R. Burford*

*S1 or S2 L4 T2*

School of Fibre Science and Technology

Head of School
Professor R. E. Griffith

The School of Fibre Science and Technology was established in 1986 to bring together the University's activities in Wool and Pastoral Sciences and Textile Technology. The objectives of the School include the provision of comprehensive education of undergraduate and postgraduate students in the science and technology of: (i) production and marketing of wool fibre and other ruminant animal products, with special emphasis on wool fibre; (ii) production and marketing of other textile fibres; (iii) processing of textile fibres and their manufacture into consumer and industrial products; and (iv) performance and properties of textile and related fibre products.

These objectives are achieved by providing an undergraduate course in Wool and Pastoral Sciences which emphasises the plant and animal sciences relevant to production in the sheep industry, as well as preparation of wool for market, specification of wool, marketing of wool and the relationship between wool production and wool processing; and by providing undergraduate courses in Textile Technology (in which there are options in Textile Chemistry, Textile Engineering and Textile Physics) and Textile Management.

While Wool and Pastoral Sciences mainly deals with wool and similar fibres such as cashmere and mohair produced by goats, as well as more general features of animal production, Textile Technology covers all fibres and all aspects of their utilisation in consumer and industrial products.

Rapidly advancing developments in the primary and secondary fibre industries make close collaboration between workers from the production and processing sides essential. Many of these developments have been stimulated by objective measurement of fibre properties; a special area of expertise of the Department of Wool and Animal Science; and the objective specification of textile products in which the Department of Textile Technology is a world leader. In the sheep industry these developments have major implications for systems of wool production particularly in areas such as nutrition, genetics, breeding and management. The School provides a unique opportunity for integration of educational and research efforts right through from production of fibres to finished textile products. The School provides a stimulating environment for students who wish to make careers in fibre based rural and manufacturing industries, both of which are critically important in the economy of Australia.

In Australia, the Textile Industry has developed mainly in the past seventy years and today it is one of our largest manufacturing groups. As in overseas countries, the impact of science and technology is bringing rapid changes to the Industry, and a consequence of this has been a strong demand for personnel skilled in Textile Technology and Management.
Department of Wool and Animal Science

Head of Department
Associate Professor J.P. Kennedy

Agricultural products, particularly wool, still contribute a significant share of Australia's export income. The pastoral industry has also played a major role in the development of the continent and the largest single form of land use still is grazing by sheep and cattle.

Farming has advanced technologically in recent years. However, innovations are continually being sought to increase productivity, raise quality and improve marketing of rural products within the framework of local and international economics. There is a continual need for the feeding and clothing of humans on a planet with finite mineral and fuel resources. This challenge must be balanced with the need for conservation and careful manipulation of a pool of renewable living resources. Wool and pastoral scientists are required to research, communicate and administer the changes which are occurring.

Undergraduate Study

Course Outlines

The School of Fibre Science and Technology participates in the Co-operative Education Program. The program applies to all three undergraduate courses taught in the School. Students in the program will complete their degree in four years, with several supervised terms of industry employment spread throughout the course. Students participating in the program will receive financial support of $9,600 per annum for each of the four years of the program. Selection into the program is based on high academic achievement and strong personal motivation for a successful career in the wool or textile manufacturing fields.

Graduates may be employed in quality control, technical management, research and development, international trade, production or general management. Within the textile industry graduates may, for example, enter any of the following areas: the manufacture of natural and man-made fibres, yarns, fabrics, etc.; dyeing, printing and finishing of textiles; quality assurance; marketing and retailing, etc.

Department of Textile Technology

The Department of Textile Technology offers courses in Textile Technology and Textile Management. Both courses extend over four years full-time study and lead to the award of the degree of Bachelor of Science. For the award of Honours, students need to have distinguished themselves in formal studies, laboratory exercises, and in their final year project. Graduates of both courses qualify for membership of the Textile Institute.

Students in both courses must complete a minimum of 40 working days approved industrial training, of which at least 30 working days training must be taken at the end of the third year of study.

It is important to stress that the specialised nature of the training provided within the Department of Textile Technology does not mean a restricted range of job opportunities after graduation. Career possibilities extend through the textile industry, allied industries (such as the production of textile chemicals and surgical dressings), private consultants, government departments and authorities, teaching at secondary and tertiary levels, and pure or applied research in various organisations.

Graduates may be employed in quality control, technical management, research and development, international trade, production or general management. Within the textile industry graduates may, for example, enter any of the following areas: the manufacture of natural and man-made fibres, yarns, fabrics, etc.; dyeing, printing and finishing of textiles; quality assurance; marketing and retailing, etc.

3170
Textile Technology - Full-time Course

Bachelor of Science
BSc

Textile Chemistry, Textile Physics, Textile Engineering Options

The conversion of textile raw materials into their finished products is simply a succession of, and an interaction between, a number of chemical, physical and engineering processes. It follows, therefore, that the disciplines involved in the study of textile technology, in addition to the technological aspects, includes a study in depth of one of the following: chemistry, engineering or physics.

Graduates will quality for membership of one of the following professional bodies, depending upon which option of the course is taken: the Royal Australian Chemical Institute; the Institute of Engineers, Australia; or the Australian Institute of Physics.

All students take a common first year, and they need not choose the option they desire to follow until the end of that year.

In Year 2 and Year 3 students specialise in one of three options of the course, viz. Textile Chemistry, Textile
Physics, or Textile Engineering. In Year 4 all students take the same subjects.

### HPW

<table>
<thead>
<tr>
<th>Year 1 All Options</th>
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<tr>
<td>CHEM1002 Chemistry 1 or</td>
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<tr>
<td>CHEM1101 Chemistry 1A, and</td>
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<tr>
<td>CHEM1201 Chemistry 1B</td>
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<td>TEXT1201 Introductory Textile Technology</td>
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<tr>
<td>FIBR1101 Fibre Science 1</td>
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<tr>
<td>MATH1032 Mathematics 1</td>
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<tr>
<td>PHYS1002 Physics 1, or</td>
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<tr>
<td>PHYS1022 Introductory Physics*</td>
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*For admission into the Textile Physics or Textile Engineering options, students must complete the subject: PHYS1002-Physics 1

### Textile Chemistry

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*Note: because of prerequisite requirements students wishing to take certain year 3 electives may substitute PHYS2031 Laboratory in year 2, and take PHYS2021 Quantum Physics and Relativity in year 3.

### HPW

<table>
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<th>Year 3</th>
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<td>CHEM3021 Organic Chemistry</td>
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<tr>
<td>Plus one of the following Chemistry electives</td>
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<tr>
<td>CHEM2031 Inorganic Chemistry &amp; Structure</td>
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<td>CHEM3121 Synthetic Organic Chemistry</td>
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<td>CHEM3321 Applied Organic Chemistry</td>
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<tr>
<td>FIBR2201 Computing Applications</td>
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<td>MATH2100 Vector Calculus</td>
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<td>MATH2120 Mathematical Methods for Differential Equations</td>
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<td>PHYS2001 Mechanics and Computational Physics</td>
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<tr>
<td>PHYS2011 Electromagnetism and Thermal Physics</td>
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<tr>
<td>PHYS2021 Quantum Physics and Relativity*</td>
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*See note for Year 2
Textile Engineering

Year 2

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<td>Electrical Power Engineering</td>
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<td>ELEC0805</td>
<td>Electronics for Measurement and Control</td>
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<td>Mathematics</td>
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Year 3

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<td>MECH2600</td>
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Year 4 (All Options)

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<td>TEXT4201</td>
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<tr>
<td>MANF4420</td>
<td>Management of Manufacturing Systems, or</td>
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<td>TEXT4702</td>
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</table>

* Coop Program students only.
† These subjects contribute towards satisfaction of the Category C General Education requirement.

3175
Textile Management - Full-time Course

Bachelor of Science
BSc

The production and marketing of textile products involves a number of manufacturing processes, and requires an understanding of basic management principles. The Textile Management course provides a comprehensive knowledge of all the textile sciences and technologies. In addition the course includes studies in economics, accounting, marketing, management, and other areas of commerce.

The course is designed to meet the need for executives in the textile and allied industries. A wide choice of electives is available in the third year of the course. This allows students to either gain a broad knowledge of the various areas of commerce, or to specialise in one of the following areas: Applied Economics; Accounting and Financial Management; or Strategic Marketing Management.
application of principles which are relevant to all aspects of pastoral production, including production and utilization of pastures; reproduction, nutrition, health, genetic improvement, ecology and management of grazing animals and the production, preparation for sale and specification of wool and meat. The course also includes study of the design and interpretation of experimental investigations, economics and business management as well as elective options on crop production, range land management and rural communications. Relevant subjects offered by other schools may also be included. An important component is the final year project whereby students engage in an area of personal research on a theoretical or experimental topic on which they are required to submit a thesis.

The course provides students with a broad overview of the pastoral industries. It aims to produce generalists rather than specialists and, although there is some scope for studying topics of special interest, the course is designed so that certain core subjects must be undertaken. Because of the broad education received, graduates are equipped for a wide variety of careers in, and associated with, agricultural production; including research, advisory work, education, marketing, management and administration. Graduates are eligible for corporate membership of the Australian Institute of Agricultural Science.

### Industrial Training Requirements

1. Students are required to obtain twenty-four weeks practical experience on commercial properties. At least twenty weeks of experience must be obtained concurrently with the course, while up to four weeks may be allowed for practical experience obtained immediately prior to the commencement of the course.

2. Students are encouraged to obtain experience in a diversity of pastoral enterprises, i.e. cattle, sheep and cropping, in different climatic zones.

3. A maximum of eight weeks shall be allowed for practical experience on any one property, including home properties. Up to eight weeks employment at research or teaching institutions is allowed towards the industrial training requirement.

4. In order to obtain recognition for practical work carried out, students shall, within six weeks of the commencement of the session immediately following the period of employment:

   (1) Submit written evidence from the owner or manager of the property or the director of the institution as to the length of employment.

   (2) Submit a written report along the guidelines which are available from the Department.

---

### Department of Wool and Animal Science

The Department offers a full-time course of four years duration leading to the award of a Bachelor of Science degree at either Honours or Pass level. The course is the only one in Australia in which special emphasis is given to wool science. In addition, studies concentrate on the most important animal industries (sheep and cattle).

Students receive a thorough grounding in the appropriate basic scientific disciplines as well as the theory and
3220
Wool and Pastoral Sciences - Full-time Course

Bachelor of Science

Year 1

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>S1</th>
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<td>FIBR1001</td>
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<td>FIBR1101</td>
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Year 2

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<td>Computing Applications</td>
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<td>Agricultural Economics and Management</td>
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Year 3

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<td>Animal Nutrition</td>
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<td>Animal Health and Welfare</td>
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Year 4

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†This subject contributes towards satisfaction of the Category C General Education requirement.

Plus at least 14 hours each session of optional subjects.
Not more than one subject in each session may be chosen from Group B.

Optional subjects

Group A

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<tr>
<td>WOOL3211</td>
<td>Crop Agronomy*</td>
<td>0</td>
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<td>WOOL3221</td>
<td>Range Management*</td>
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<td>WOOL3511</td>
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Group B

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<td>MARK2012</td>
<td>Marketing Fundamentals</td>
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<tr>
<td>MARK2052</td>
<td>Marketing Research</td>
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<tr>
<td>MICR2201</td>
<td>Introductory Microbiology</td>
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Some subjects may not be offered in all years.

*Available in alternate years.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

Students should note that enrolment in all later year subjects taught by the School is subject to satisfactory course progression and approval of the Head of the School.

APSE0002
Social Issues in Applied Science
Staff Contact: Dr Jean Cross
S1 L1 T1

The subject covers social issues arising from future technological developments and the role that a professional applied scientist can play in influencing future directions. It will be taught by a combination of group activity, case studies and projects and seminars from visiting speakers, some of whom will be from disciplines other than the applied sciences.
School of Fibre Science and Technology

FIBR1001
Natural Fibre Production
Staff Contact: A/Prof David Cottle
S2 L3 T3
Introduction to the world and Australian wool and cotton industries; fibre and skin biology; mechanisms of, and factors affecting, fibre growth and morphology; introduction to wool and cotton production, harvesting, preparation for sale; wool types and marketing.

FIBR1101
Fibre Science 1
Staff Contact: Dr Shantha David
S1 L2 T2

FIBR2201
Computing Applications
Staff Contact: A/Prof John James
S2 L2 T2
Introduction to hardware and software concepts; operating systems. Introduction to computer programming: simple algorithms and data organisation. Computer applications in fibre science and technology: computer-aided design and manufacture CAD CAM; process monitoring and control, computer-integrated manufacture CIM; data acquisition; modelling and optimisation techniques; databases, spreadsheets, text word processing.

Department of Textile Technology

Students should note that enrolment in all later year subjects taught by the Department is subject to satisfactory course progression and approval of the Head of Department.

TEXT1101
Science for Textiles
Staff Contact: A/Prof Michael Pailthorpe
S2 L2
The atomic structure of matter; x-rays; optics and optical instruments; wave theory. Properties of elements and compounds; introductory organic chemistry.

TEXT1201
Introductory Textile Technology
Staff Contact: Prof Ross Griffith
S2 L3 T1
Sampling theory and practice for textile testing. Introductory statistics for data processing. Basic techniques for the measurement of fibre properties, including transverse dimensions and length. The application of engineering principles to textile machines and processes, including mechanics of solids, statics, mechanical transmission of power.

TEXT2101
Fibre Science 2
Staff Contact: Prof Ron Postle
S2 L2 T2

TEXT2201
Textile Statistics
Staff Contact: Dr Xungai Wang
S2 L2
Application of mathematical techniques to textile data processing and analysis. Probability theory, distribution functions, tests of significance. Analysis of variance, regression analysis. Use of computer statistical packages including SPSSX.

TEXT2301
Yarn Technology 1
Staff Contact: Dr Xungai Wang
S1 L3 T3
The preparation of staple fibres for yarns and nonwoven fabrics: processes for tow conversion, opening, cleaning, blending, carding, drawing, and combing. Short-staple, worsted and woollen preparation systems. Computer blend selection; drafting theory; theory and measurement of irregularity; levelling of slivers.

TEXT2401
Fabric Technology 1
Staff Contact: Dr John Curiskis
S2 L3.5 T2.5

TEXT3101
Textile Structures 1
Staff Contact: Prof Ron Postle
S1 L1 T2
TEXT3301
Yarn Technology 2
Staff Contact: Dr Xungai Wang
S2 L3 T3

TEXT3401
Fabric Technology 2
Staff Contact: Dr John Curiskis
S1 L3.5 T2.5

TEXT3501
Finishing Technology A
Staff Contact: Dr Shantha David
S1 L2 T2
Objects of finishing and typical flow diagrams for wool and cotton. The principles and technology of textile finishing processes for protein and cellulosic fabrics, including the removal of impurities and discoloration, the elimination or minimisation of deficiencies in properties, the development of specific properties. Properties of surfactant solutions, micelle formation, surfactants as emulsifiers and detergents, detergency.

TEXT3601
Colour Science
Staff Contact: A/Prof Mike Pailthorpe
S1 L2 T1

TEXT3602
Colouration Technology
Staff Contact: A/Prof Mike Pailthorpe
S2 L2 T2

TEXT3801
Textile Engineering
Staff Contact: Prof Ross Griffith
S2 L2 T1

TEXT4003
Project
Staff Contact: A/Prof Michael Pailthorpe
F S1 T5 S2 T9
Students are required to carry out a research project and to submit a thesis describing their investigations. It is usual for students to be allocated projects in areas related to the particular course option they are studying.

TEXT4101
Seminar
Staff Contact: A/Prof Michael Pailthorpe
F T2
Students prepare and present a seminar before an audience consisting of staff of the Department, final year students, Graduate Diploma students, and any other interested undergraduate or postgraduate students, on a subject of topical and specific interest in the field of textile science, technology or management, and subsequently submit the seminar in writing.

TEXT4102
Composites
Staff Contact: Dr Shantha David
F T3
The production of specified dimensions in textile fabrics; heat, chemical and mechanical processes, surface
finishes, protective finishes. The application of special finishes including flame-proof finishes, crease-resistant finishes, etc. Dimensional stability and its measurement. Recent developments in finishing technology.

**TEXT4701 Textile Industry Studies**  
*Staff Contact: Prof Ross Griffith*  
S1 L T3  
Econometrics of the textile and clothing industries. Models of production, import and export and consumption of textiles and clothing in Australia, and comparison with world data. Case studies in textile and clothing manufacture operations. Recent developments in fabric forming technology. Environmental considerations in relation to pollution from the textile industry. Waste water treatment methods. The employment function of the textile and clothing industries. Social and political consequences of automation: polarisation of workforce into highly-skilled and unskilled workers; conflict between maintaining a viable industry and maintaining employment levels.

**TEXT4702 Textile Management**  
*Staff Contact: Prof Ross Griffith*  
S1 T6  
Selected readings in the Management of manufacturing systems with particular reference and examples from specific manufacturing enterprises.

**Department of Wool and Animal Science**

**WOOL2103 Livestock Production 1**  
*Staff Contact: A/Prof John Kennedy*  
C6 F L2  
The sheep and beef cattle industries and their place in the economic life of Australia; levels of production and trends. The physical, biological, managerial and economic conditions influencing production. Sheep producing zones. Sheep breeds for wool production. Cross breeding, prime lamb production. Sheep and cattle management; nutrition, reproduction, survival. A field excursion of one week's duration is held in Session 1.

**WOOL2203 Agronomy**  
*Staff Contact: Dr Gordon King*  
S1 L2 T1 S2 L3 T3  

**WOOL2303 Agricultural Economics and Management 1**  
*Staff Contact: Mr Steve Filan*  
F L2 T1  
Farm planning methods. Budgeting, gross margins, simplified programming and introduction to linear programming. Use of VAX computers: introduction to operating system, text editor, and linear programming software. Introduction to farm management implications of land tenure and title; valuation; depreciation; discounting; taxation. Economic principles. Introduction to production economics theory, cost curves, and price theory.

**WOOL2503 Wool Science 1**  
*Staff Contact: A/Prof David Cottle*  
F L2 T1  
(Preparation and Early Stage Processing) Fleece characteristics and their variation; wool faults; clip preparation - past, present and future; evaluation and typing of wool; value and use of wool; felting; fellmongering; marketing. Early stage processing and yarn manufacture.

**WOOL2601 Animal Physiology 1**  
*Staff Contact: A/Prof John Kennedy*  
S2 L3 T3  
*Prerequisite: BIOS1021*  
Physiology systems of mammalia are treated with special attention to homeostasis. Cell-membranes; blood and body fluids; the immune reaction. Cardiac control, functions and haemodynamics. Respiration. The endocrine system with particular emphasis upon growth, reproduction, lactation and stress. The nerve impulse, its excitation and transmission. Physiology of digestion, the gastrointestinal tract and of the kidney. Heat tolerance and climatic adaptation.

**WOOL3111 Livestock Production 2**  
*Staff Contact: Dr Doug Murray*  
C3 S2 L2 T1  
*Prerequisite: WOOL2103*  
The scope for intensification of ruminant production. The behaviour, nutrition, environmental physiology and health of intensively managed animals. Housing and environmental control of facilities. Examples of intensification, e.g. feed lots, sea transport.

**WOOL3203 Pastoral Agronomy**  
*Staff Contact: Dr Gordon King*  
C6 F L3 T1  
*Prerequisite: WOOL2203*  

**WOOL3211 Crop Agronomy**  
*Staff Contact: Dr Gordon King*  
S2 L2 T1  
*Prerequisite: WOOL2203*  
WOOL3221
Range Management
Staff Contact: Dr Gordon King
S2 L1 T2
Co or Prerequisite: WOOL3203

WOOL3401
Animal Nutrition
Staff Contact: Dr Geoff Robards
S2 L3 T1
Composition and classification of foodstuffs and pastures. Physiology of ruminant digestion. Digestion absorption and metabolism of carbohydrates, proteins, fats, mineral and vitamins. Digestibility of foodstuffs. Nutrient and energy balances and requirements of livestock. Feeding standards and the quantitative application of nutritional data with particular reference to Australian conditions. Utilisation of forage by grazing ruminants. Supplementary and drought feeding. Consideration of disorders due to nutrition. While particular emphasis is given to nutritional requirements of sheep, those of other farm livestock are dealt with in this section.

WOOL3503
Wool Science 2
Staff Contact: A/Prof David Cottle
F L2 T1
(Metrology and late stage processing) Sampling wool for measurement; measurement of fibre diameter, length, colour, yield, vegetable matter, regain, resistance to compression, bulk, medullation, dark fibres and style; test certificates; statistics; standards; use of measurements in marketing and manufacture; fabric manufacture, dyeing and finishing.

WOOL3511
Wool Marketing
Staff Contact: A/Prof John Kennedy
S2 L2 T1
Wool marketing systems; comparison with other countries, modelling. Wool commerce; financial factors. Information systems. Future directions.

WOOL3701
Animal Health and Welfare 1
Staff Contact: A/Prof John Kennedy
S1 L2 T1
Prerequisite: WOOL2103

WOOL3803
Genetics 1
Staff Contact: A/Prof John James
F L2 T1

WOOL3901
Biostatistics 1
Staff Contact: A/Prof John James
S1 L2 T2
Design and analysis of comparative experiments, for continuous and discrete random variables. Analysis of variance for fixed, mixed and random models. Linear regression and correlation. Multiple comparison methods.

WOOL4003
Project
Staff Contact: A/Prof John Kennedy
F T6
Students are required to conduct an experimental or theoretical investigation under supervision and to submit a thesis describing the results of their investigations. Throughout the year students are required to submit progress reports to their supervisors and to present seminars. The written reports of the project shall be submitted by the last day of Session 2.

WOOL4013
Seminar
Staff Contact: A/Prof John Kennedy
F T2
Seminars deal with research and or development work being undertaken or recently completed by students and staff of the Department of Wool and Animal Science, other University schools and research organisations. There are also seminars on communication in wool and pastoral sciences and on problems facing rural industries.

WOOL4113
Livestock Production 3
Staff Contact: A/Prof John Kennedy
C6 F L1 T2

WOOL4413
Ruminant Nutrition
Staff Contact: Dr Geoff Robards
S1 L2 T2
Prerequisite: WOOL3401
Utilization of metabolizable energy; protein digestion and utilization; digestion of complex carbohydrates; digestive upsets: bloat, acidosis, rumen stasis; techniques for measuring nutrient dynamics and body turnover rates;
formulation of specialised rations for: feedlots, live sheep trade, Sharlea wool production, milk production.

**WOOL4513**  
Wool Science 3  
*Staff Contact: A/Prof David Cottle*  
F L2 T2

(Advanced Technology) Sale by description; modelling wool production; developmental metrology techniques; the Australian wool processing industry; breeding for wool quality; woollen metrology; keratin fine structure; caprine and cameloid fibres; processed wool metrology; wool classification; lot building; current wool research and development.

**WOOL4813**  
Genetics 2  
*Staff Contact: A/Prof John James*  
F L2 T2  
*Prerequisite: WOOL3803*


**WOOL4911**  
Biostatistics 2  
*Staff Contact: A/Prof John James*  
S2 L2 T2

Least squares methods, applied to multiple regression and experimental design models. Factorial experiments. Analysis of co-variance. Elements of multi-variate analysis.
Course Outlines

Department of Textile Technology

The Department conducts a course which leads to the award of a Graduate Diploma in Textile Technology.

In addition, the Department welcomes inquiries from graduates in Science, Engineering and Applied Science who are interested in doing research leading to the award of the degrees of Master of Science or Doctor of Philosophy.

5090 Textile Technology Graduate Diploma Course

Graduate Diploma GradDip

The course leading to the award of Graduate Diploma in Textile Technology is designed to prepare graduates for careers in the textile and allied industries. It also provides formal studies for graduates who are already employed in the textile industry. The normal requirement for admission to the course is a Bachelor degree or equivalent tertiary qualification.

The following program, which comprises both formal lectures and laboratory work, may be taken as a one year full-time course or two-year part-time course.

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<th>TEXT5003</th>
<th>TEXT5101</th>
<th>TEXT5102</th>
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<td>Fibre Science A</td>
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Plus two electives per session (averaging not less than 9 hours per session), selected from the following:

| TEXT5301 | Yarn Technology A | 5 0 |
| TEXT5302 | Yarn Technology B | 0 5 |
| TEXT5401 | Fabric Technology A | 0 5 |
| TEXT5402 | Fabric Technology B | 5 0 |
| TEXT5501 | Finishing Technology A | 5 0 |
| TEXT5502 | Finishing Technology B | 0 5 |
| TEXT5601 | Colour Science | 4 0 |
| TEXT5602 | Dyeing Technology | 0 4 |

Candidates wishing to specialise in the science and technology of textile dyeing and finishing (chemistry orientation) should undertake the optional subjects TEXT5501, TEXT5502, TEXT5601 and TEXT5602.

Department of Wool and Animal Science

The Department conducts a course which leads to the award of a Graduate Diploma in Wool and Pastoral Sciences.

In addition, the Department welcomes inquiries from graduates in Science, Agriculture and Applied Science who are interested in doing research leading to the award of the degrees of Master of Science or Doctor of Philosophy.

5081 Wool and Pastoral Sciences Graduate Diploma Course

Graduate Diploma GradDip

The course leading to the award of the Graduate Diploma in Wool and Pastoral Sciences is specially designed for graduate students preparing themselves for careers in the pastoral industry. One of the principal functions of the course is to provide a bridge from other disciplines such as Agriculture, Veterinary Science and Pure Science for graduates who wish to study and work in the field of Wool and Pastoral Sciences, which is of such overall importance to Australia.

The normal requirement for admission to the course is a degree in Agriculture, Applied Science, Veterinary Science or Science in an appropriate field. In addition, students may be required to take a qualifying examination. Such qualifying examination will be of a standard which will ensure that the student has sufficient knowledge of the subject and the principles involved to profit by the course.

The following program may be completed in one year on a full-time basis. Students are required to carry out full-time study to the extent of eighteen hours lecture and laboratory work per week for two sessions. Both graduate subjects and undergraduate subjects may be chosen to suit the
requirements of the student subject to their availability and
the approval of the Head of the School.

Full-time Course

18 hours per week of which at least 10 must be chosen from:

<table>
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<tr>
<th>Subject Code</th>
<th>Subject Title</th>
<th>Hours</th>
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<tr>
<td>WOOL5113</td>
<td>Livestock Production</td>
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<tr>
<td>WOOL5213</td>
<td>Range Management</td>
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<tr>
<td>WOOL5513</td>
<td>Wool Science</td>
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<td>WOOL5813</td>
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</tr>
<tr>
<td>WOOL5913</td>
<td>Quantitative Methods</td>
<td>4</td>
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</table>

A maximum of 8 hours per week of study may be selected
from approved undergraduate subjects.

Graduate Diploma students are expected to work at the
level of honours students in the undergraduate courses and
to carry out prescribed study of current research material
in the appropriate field.

Graduate Programs in Rangeland Management

Programs are available leading to the award of Graduate Diploma in Rangeland Management (Course 5025) in the
following areas of study:

Range Management

For course details see Graduate Study in the School of Geography section.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric
order within organizational units. For academic advice
regarding a particular subject consult with the contact for
the subject as listed. A guide to abbreviations and prefixes
is included in the chapter 'Handbook Guide', appearing
earlier in this book.

Department of Textile Technology

TEXT5001
Textile Technology Dissertation
Staff Contact: A/Prof Michael Pailthorpe
F T1.5

Students review a particular aspect of textile technology,
by conducting a literature survey and conferring with
experts. The review is presented orally to the staff and
students of the department, and submitted in written form.

TEXT5003
Textile Technology
Staff Contact: Prof Ross Griffith
F T1.5

Students gain an overview of textile technology by
reviewing the technology relating to one or more textile
products, through a series of tutorials and exercises.

TEXT5101
Fibre Science A
Staff Contact: A/Prof John Kennedy
S1 L4 T2

Fibre classification and raw materials. Necessary and
desirable attributes of textile fibres. Production of natural
and man-made fibres. Physics and chemistry of natural and
man-made fibres. Introduction to fibre morphology and fibre
structure. Introductory statistics and sampling theory. Basic
techniques for the measurement of fibre properties. Fibre
transverse dimensions and length. Practical fibre
identification. World production and consumption of textile
fibres.

TEXT5102
Fibre Science B
Staff Contact: Dr Shantha David
S2 L2 T2

Fibre microscopy. Electron microscopy. Fibre reflection
and lustre. X-ray Morphological and fine structure of fibres.
Crystallography. Polymer crystallisation. Molecular
structure of proteins. Optical properties and fibre
Mechanical properties. Moisture sorption and swelling.
Addition and condensation polymerisation. Chemical
constitution and reactivity of man-made fibres. Introduction
to high technology fibres.

TEXT5201
Textile Quality Control
Staff Contact: A/Prof Mike Pailthorpe
S2 L T2

User-serviceability testing. Fibre content and
problems.

TEXT5301
Yarn Technology A
Staff Contact: Dr Xungai Wang
S1 L3 T2

The preparation of staple fibres for yarns and non-woven
fabrics: processes for tow conversion, opening, cleaning,
blending, carding, drawing, and combing. Short-staple,
worsted and woollen preparation systems. Computer blend
selection; drafting theory; theory and measurement of
irregularity; levelling of slivers.

TEXT5302
Yarn Technology B
Staff Contact: Dr Xungai Wang
S2 L3 T2

Properties of yarns. Introduction to geometry and
mechanics of twisted structures. Staple yarn forming by
ring, rotor and unconventional spinning methods. Twisting
and winding processes. Throwing and texturing of
continuous filament yarns. On-line monitoring of production
and quality; automation. Measurement of yarn properties.
TEXT5401
Fabric Technology A
Staff Contact: Dr John Curiskis
S2 L3.5 T1.5

TEXT5402
Fabric Technology B
Staff Contact: Dr John Curiskis
S1 L3.5 T1.5

TEXT5501
Finishing Technology A
Staff Contact: Dr Shantha David
S1 L3 T2
Objects of finishing and typical flow diagrams for wool and cotton. The principles and technology of textile finishing processes for protein and cellulosic fabrics, including the removal of impurities and discolouration, the elimination or minimisation of deficiencies in properties, the development of specific properties. Properties of surfactant solutions, micelle formation, surfactants as emulsifiers and detergents, detergency.

TEXT5502
Finishing Technology B
Staff Contact: Dr Shantha David
S2 L2 T3
The production of specified dimensions in textile fabrics; heat, chemical and mechanical processes, surface finishes, protective finishes. The application of special finishes including flame-proof finishes, crease-resistant finishes, etc. Dimensional stability and its measurement. Recent developments in finishing technology.

TEXT5601
Colour Science
Staff Contact: A/Prof Mike Pailthorpe
S1 L2 T2

TEXT5602
Dyeing Technology
Staff Contact: A/Prof Mike Pailthorpe
S2 L2 T2


Department of Wool and Animal Science

WOOL5113
Livestock Production
Staff Contact: A/Prof J P Kennedy
C12 F L2 T4
Biology of reproduction and reproductive performance of sheep and cattle; growth and body composition; meat production and quality.

WOOL5213
Range Management
Staff Contact: Dr Gordon King
C3 F L1 T3

WOOL5223
Project In Range Management
Staff Contact: Dr Gordon King
C9 F T9
A theoretical and or experimental investigation of some aspect of management of rangelands.

WOOL5513
Wool Science
Staff Contact: A/Prof David Cottle
F L2 T4
WOOL5813
Animal Breeding
Staff Contact: A/Prof John James
F L2 T2
Corequisite: WOOL3803
Definition of breeding objectives; case studies of production recording and breed improvement programs for sheep and beef cattle. Development of performance recording systems: choice of traits to be recorded, recording and processing methods. Estimation of breeding value from performance records. Breed evaluation. Optimal design for breeding programs. The impact on genetic improvement of techniques for controlling reproduction.

WOOL5913
Quantitative Methods
Staff Contact: A/Prof John James
F L2 T2
Selected topics in: biostatistics, with emphasis on experimental design and on least squares procedures; mathematical programming methods for rural industries; data processing and computer programming; systems analysis and simulation methods.
Geographers study the spatial relationships of the phenomena which form humans' physical and social environment, and aim to establish principles which govern those relationships. The geographer may concentrate on specific variables, as in systematic geography, or may deal with variables which affect a specific area, as in regional geography.

The cultural significance of geography lies in its contribution to an understanding of the total environment, but the geographer's skills also find practical application in the conservation and planned development of resources. Increasing numbers of geographers are employed as professionals in these applications. For instance, geomorphologists and biogeographers are undertaking resource inventory surveys and environmental assessment, and economic geographers are engaged as urban and regional planners and spatial analysts.

General Education Electives

For details of the General Education requirements see Faculty Information.

Students are advised to check notices displayed in the School of Geography ground floor foyer in case of any late changes in teaching arrangements.

Undergraduate Study

Course Outlines

The three vocationally-oriented Applied Geography programs 3010 in the Faculty of Applied Science provide an analytical approach to understanding and investigating some of society’s most pressing problems, including the use and management of scarce resources, the interaction between people and environment, soil erosion and conservation, land use conflicts, and spatial inequalities in economic and social wellbeing. These courses provide elective specializations in physical geography (with special emphasis on either the biologic or geomorphic aspects), economic geography with emphasis on spatial analysis, and in human and physical resources (with emphasis on the integration of human and physical geography).

Geography is also available as a major sequence in the Arts course 3400, where the emphasis is on the study of where and how people live, and on their activities in relation to the environment.

Major sequences in Science and Mathematics course 3970, programs 2700 and 6581 study the relationships between people and the physical environment, combining geographical studies, particularly in physical geography, with those in related disciplines, notably the biological and earth sciences.

Geography may also be combined with Civil Engineering in course 3730, and with Law in course 4770.

Students may enrol through the School of Geography for higher research degrees, or for formal graduate courses
such as the Master of Applied Science in Geographic Information Systems 8024; Masters' and Diploma courses in Remote Sensing 8026 and 8056, or Masters' and Diploma courses in Rangeland Management 8025 and 5025, Masters' in Environmental Management 8046 and may undertake projects in the School as part of the Master of Environmental Studies degree 8045.

Applied Geography - Full-time Courses

Bachelor of Science

The School offers three four-year full-time courses leading to the award of the degree of Bachelor of Science, which aim to train professional geographers for entry into applied fields.

There are elective specializations in physical geography (with special emphasis on either the biologic or geomorphic aspects), economic geography (with emphasis on urban and regional analysis), and in human and physical resources with emphasis on the integration of physical and human geography). First year subjects involve systematic studies of the physical and economic bases of geography. There is progressive specialization in the following years, with heavy emphasis on field observation and data handling. For the award of the degree at Honours level students will be required to have distinguished themselves in coursework, in additional assignments as directed by the Head of the School, and in the final year project for which a Report will be required.

All students are encouraged to spend a period of four to six weeks with organizations concerned with the investigation and planned use of resources et cetera.

Several units in Geography include laboratory and project work involving the use of computer and quantitative techniques. It is required that students provide their own drawing materials such as tracing and graph paper. Details of exact requirements are given at the beginning of the relevant subjects. Compulsory fieldwork incurs personal expenditure and for some subjects notes and materials are available for a small charge.

3010.1000/2000/3000

Applied Geography - Full-time Course

Bachelor of Science
BSc

Applied Physical Geography, Applied Economic Geography and Human and Physical Resources

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* Note: Credit necessary to take ECON2203 and ECON2204

Applied Physical Geography (3010.1000)

Year 2

| GEOG2000 Field Project 2 | 1.5 1.5 |
| GEOG2013 Geographic Data Analysis | 4 0 |
| GEOG2021 Introduction to Remote Sensing | 0 4 |
| GEOG3021 Biogeography | 4 0 |
| GEOG3051 Soils and Landforms | 4 0 |
| GEOG3122 Geographic Information Systems | 0 4 |
| GEOG3211 Australian Environments and Natural Resources | 0 4 |

and either

| GEOL2011 Mineralogy and Igneous Petrology | 6 0 |
| and GEOL2022 Petrology and Structural Geology | 0 6 |
| or any two of the following |
| BIOS201 Introductory Genetics | 0 6 |
| BIOS2031 Biology of Invertebrates | 0 6 |
| BIOS2051 Flowering Plants | 0 6 |
| BIOS2061 Vertebrate Zoology | 6 0 |

and for all students

| General Education Subject/s (Category A) | 2 2 |
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### Year 2

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### Year 1

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### Human and Physical Resources (3010.3000)

### Year 2

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### Year 1

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*One subject may be substituted for those listed with permission of Head of School.*

Year 4 All Strands

- GEOG3042 Environmental Impact Assessment
- GEOG4010 Field Project 4
- GEOG4031 Project
- GEOG4042 Practical Applications†
- GEOG4052 Advanced Spatial Analysis*
- GEOG4062 Advanced Environmental Analysis*

Totalling 19 20

*Up to two subjects may be substituted from those offered by the School of Geography, Department of Applied Geology or School of Biological Sciences, subject to approval by the Head of School.
†This subject contributes towards satisfaction of the Category C General Education requirement.

Note: Students will incur personal costs in connection with project work in the final year of study.

### Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

**GEOG1000**

**Field Project 1**

*Staff Contact: Drs B. Parolin, I. Prosser*

*1 T4*

A five days field project normally undertaken during the midyear recess, designed to support teaching in Year 1 Level 1 subjects and to develop basic field methods and skills. Students will incur some personal expenses in connection with this subject, which is a compulsory part of the course.

**GEOG1022**

**Locational Processes**

*Staff Contact: Dr B. Parolin*

*2 L2 T2*

Basic theoretical constructs for explaining the location of human activity. Concepts of optimal location and spatial competition, geographical variations in the factors of production, economies of scale and agglomeration, transaction costs and locational decision making under conditions of uncertainty. Practical study links theory and problem solving in economic geography.

**GEOG1031**

**Environmental Processes**

*Staff Contact: A/Prof M. Fox, A/Prof M. Melville & Mr A. Evans*

*S2 L2 T2*

Note/s: Excluded GENS4240.

Essential and continuing links between components of the physical environment. Movement of energy and matter in the physical environment, including consideration of Earth's energy balance, the hydrological cycle, nutrient cycles in vegetation and soil, imbalances leading to land degradation and instability, and to movement of materials.

**GEOG1043**

**Data Processing Systems**

*Staff Contact: Mr S. Filan*

*S1 L2 T2*

Measurement, management, analysis and display of general and spatial data. Basic use of VAX computers; operating systems and file management. EDT editor. Use of software (SPSS*) for management, processing, analysis and display of data.

**GEOG1044**

**Data Display Systems**

*Staff Contact: Prof B. Garner*

*S2 L2 T2*

Prerequisite: GEOG1043

GEOG1051
Global Environmental Problems and Processes
Staff Contact: Dr I. Prosser
S1 L2 T1
The subject outlines the principles and processes necessary to appreciate the physical background behind major globalscale environmental problems. Principles and processes include the linkages between the lithosphere, hydrosphere and biosphere, atmospheric circulation, energy and radiation balance and ecosystem function. Problems covered are the issues of desertification, deforestation, 'greenhouse', ozone depletion, energy conservation and pollution.

GEOG1062
Australia and Global Development
Staff Contact: A/Prof J. Burnley, Drs M. Sant, P. Simons
S2 L2 T1
The main concern is the progressive integration of Australia into global capitalism and the developmental and environmental consequences of this process in Australia and Pacific Rim countries and adjacent territories. Topics covered include colonial and dependent development in Australia and resource use; applications of development theory as applied to coreperiphery relationships between world financial centres and Australia, and between Australia and Pacific Island territories; transnational organisations and technology transfer and investment in Australia and Pacific countries; the relationship between changing trade patterns, production and development in Australia and Pacific Rim countries; Australia in a future world.

GEOG2000
Field Project 2
Staff Contact: A/Prof J. Dodson & A/Prof M. Fox (Physical)
Dr M. Sant & Mr S. Filan (Economic)
F T3
Note/s: Students will incur personal costs.
A five days field project normally undertaken during a recess designed to support teaching in Year 2 subjects in physical and economic geography and to develop more advanced skills in data collection, observation and field methods. Students will incur some personal expenses in connection with this subject, which is a compulsory part of the course.

GEOG2013
Geographical Data Analysis
Staff Contact: A/Prof J. Dodson
S1 L1 T3
Prerequisite: Both GEOG1051 and either GEOG1031 or GEOG1062
Note/s: Excluded GEOG2093.
Inferential statistics and hypothesis testing in the analysis of spatial data. Methods of sampling, comparing populations and of identifying relationships through correlation, association, regression, time series and classification. Topics covered are applicable to physical and economic geography.

GEOG2021
Introduction to Remote Sensing
Staff Contact: Mr A. Evans
S2 L2 T2
Prerequisite: Successful completion of a Year 1 program in Applied Science, Science or Arts or equivalent as approved by the Head of School
Principles and technical aspects of remote sensing. Forms of available imagery, their utility and facilities for interpretation. Basic airphoto interpretation techniques relevant to environmental assessment. Introduction to principles of the electromagnetic spectrum, photometry and radiometry. Sensor types, image formation and end products associated with selected satellite programs, including Landsat. Land-cover and land-use interpretation procedures in visual image analysis. Basic procedures in machine-assisted image enhancement.

GEOG2032
Geomorphology
Staff Contact: Drs W. Erskine, I. Prosser
S2 L2 T2
Prerequisites: GEOG3051
Drainage basin processes including: weathering, the production of runoff and sediment, sediment tracing, sediment budgets and denudation histories. The processes of river channel changes including sediment transport, hydraulics, hydrology, hydraulic geometry and channel patterns. There will be an emphasis on the application of geomorphic principles to land management.

GEOG2041
Mathematical Methods for Spatial Analysis
Staff Contact: Mr S. Filan
S1 L2 T2
Prerequisite: MATH1011 and MATH1021 or MATH1032 or MATH1042 and GEOG1043 or FIBR2201
Selected mathematical methods for the analysis of spatial problems, including applications of calculus in constrained and unconstrained optimisation; mathematical programming methods; network models; input-output analysis; in facility location and allocation problems.

GEOG2052
Project in Spatial Analysis
Staff Contact: Dr M. Sant & Mr S. Filan
S2 L1 T3
Prerequisite: GEOG2041
Supervised application of quantitative methods in selected projects involving the analysis of spatial data and requires integrated applications of skills in data processing, geographic data analysis, and mathematical methods.

GEOG2061
Regional Theory
Staff Contact: Dr M. Sant
S1 L2 T2
Regional theory and analytical methods with a particular focus on the explanation of the Richardson growth model and the practical application of its components, using Australian data. Capital formation and mobility, labour supply and technological change, assessments of recent changes in the Australian regional economic system.
Practical work deals with the measurement and analysis of structural change, accessibility and economic interaction and regional economic welfare.

**GEOG2071**  
Transport and Land Use  
*Staff Contact: Dr B. Parolin*  
S2 L2 T2
The relationships between transport and land use, mobility, accessibility, and activity systems in urban and rural environments. Emphasis on policy issues and case studies from Australia. Introduction to simple transport-land use models.

**GEOG2092**  
Australian Social and Economic Landscapes  
*Staff Contact: A/Prof I. Burnley & Dr P. Simons*  
S1 L2 T2
Prerequisite: GEOG1062
Analysis of the principal factors and forces shaping the contemporary social and economic landscapes of Australia and the problems arising. Themes include Australia's changing population profile and distribution, the changing face of Australian cities, regional disparities in social and economic well-being, changing patterns of employment and industrial location, and the declining fortunes of rural Australia. Planning and policy responses to the problems of spatial change and re-organisation are emphasised and future scenarios addressed.

**GEOG2093**  
Geographic Methods  
*Staff Contact: Dr S. Walker*  
S2 L2 T2
Prerequisite: Both GEOG1051 and either GEOG1031 or GEOG1062  
*Note/s:* Excluded GEOG2013.
Statistical procedures and field methods used in both human and physical geography. Includes: measures of dispersion; measures of spatial distribution; samples and estimates; correlation and regression; tests for distribution in space; data collection and analysis; field observations. Three days field work is a compulsory part of the subject and students will incur some personal expenses with this.

**GEOG3000**  
Field Project 3  
*Staff Contact: A/Prof M. Melville (Physical), Prof B. Garner & Dr B. Parolin (Economic)*  
F T1.5
Prerequisite: One of GEOG3011, GEOG3021, GEOG2032. This prerequisite does not apply to students registered in course 3010  
*Note/s:* Students will incur personal costs.
A five days field project normally undertaken during a recess, designed to support teaching in Year 3 Level III subjects in physical and economic geography and to demonstrate the application of field methods in problem solving and research projects. Students will incur some personal expenses in connection with this subject, which is a compulsory part of the course.

**GEOG3011**  
Pedology  
*Staff Contact: A/Prof M. Melville*  
S1 L2 T2
Prerequisites: GEOG1031 or GEOG1051 and one of CHEM1101 or CHEM1401 or both GEOL1101 and GEOL1201 or both BIOS1011 or BIOS1021
Methodology of pedogenic studies and the application of these studies to the understanding of soil and landform relationships. Soil physical and chemical properties and their interrelationships, emphasizing claymineral structure and behaviour, soil solution chemistry, soil water movement and the application of these properties to elements of soil mechanics. Soil properties in natural, rural and urban landscapes, including assessment of soil fertility, swelling characteristics, dispersibility, erodibility and aggregate stability. Laboratory analysis of soil physical and chemical characteristics with emphasis on properties associated with land capability assessment. Statistical analysis of soil data and its application to mapping. The use of soil micromorphological and mineralogical studies in pedology.

**GEOG3021**  
Biogeography  
*Staff Contact: A/Prof J. Dodson & A/Prof M. Fox*  
S2 L2 T2
Prerequisites: GEOG1031 or GEOG1051 or both BIOS1011 and BIOS1021

**GEOG3032**  
Remote Sensing Applications  
*Staff Contact: Mr A. Evans*  
S1 L2 T2
Prerequisite: GEOG2021 or SURV8711
Spectral characteristics of natural phenomena and image formation. Ground truthing, collection and calibration. Introduction to computer classification procedures. Multitemporal sampling procedures, image to image registration and map to image registration. Major applications of remote sensing in the investigation of renewable and non-renewable resources to include: soils, geology, hydrology, vegetation, agriculture, rangelands, urban analysis, regional planning, transportation and route location and hazard monitoring.

**GEOG3042**  
Environmental Impact Assessment  
*Staff Contact: Prof B. Garner & Dr W. Erskine*  
S2 L2 T2
Prerequisites: GEOG1031 or GEOG1051 or by permission from Head of School
Rationale and basic objectives; history and legislative framework: standardized types of environmental impact
assessment EIA, including matrix approach, adopted methods of EIA in Australia. Techniques of impact evaluation in terms of socio-economic criteria. Environmental decision making and planning under conditions of uncertainty. Case studies exemplifying procedures, techniques and issues. Trends, changes and possible future developments in EIA. Practical exercises representing components of typical EIAs.

GEOG3051
Soils and Landforms
Staff Contact: Drs W. Erskine, I. Prosser
S1 L2 T2
Prerequisite: GEOG1031 or GEOG1051
An introduction to soil classification schemes with particular emphasis on the soils and landforms of floodplains and the Riverine Plain, NSW. Long term development of landscapes with emphasis on the evolution of mountain ranges. Arid zone and coastal landforms emphasising current processes and Quaternary history.

GEOG3062
Environmental Change
Staff Contact: A/Prof J. Dodson
S2 L2 T2
Prerequisite: Successful completion of a Year 2 Programme in Applied Science, Science, or Arts or equivalent as approved by the Head of School

GEOG3082
Project Design and Formulation
Staff Contact: Dr P. Simons
S2 L2 T2
Stages in the design of a research project. Undertaking a literature review relating to the project. Identification and formulation of working hypotheses. Writing up a research proposal. Timetables and planning strategies for project execution and completion.

GEOG3101
Sample Surveys and Analysis
Staff Contact: Drs P. Simons & B. Parolin
S1 L2 T2
An introduction to sample survey data collection methods and techniques for the analysis of survey data. Topics include research design methods, questionnaire design and implementation and the analysis of categorical survey data using log-linear, logit and regression approaches.

GEOG3122
Geographic Information Systems
Staff Contact: Prof B.J. Garner & Mr S. Filan
S2 L2 T2
Prerequisite: GEOG3161 or by permission from the Head of School This prerequisite does not apply to students enrolled in course 3010.
An introduction to information systems of particular relevance for geographers with special reference to computer-based systems for resource evaluation. Case study evaluation, application of the MAP and other GIS software.

GEOG3132
Marketing Geography
Staff Contact: Dr P. Simons
S2 L2 T2
Prerequisite: MARK2042 This prerequisite does not apply to students enrolled in course 3010
Organization and operation of the marketing function and trends in its performance. Merchandising strategies of wholesalers and retailers and the consequent location patterns of consumer oriented enterprises within cities. Retail feasibility studies and the structure and analysis of market areas in intraurban areas. Consumer spatial behaviour, including search and decision processes. Shopping centre images and spatial choice models.

GEOG3142
Geographic Information Systems Applications
Staff Contact: Dr Q. Zhou
S1 L2 T2
Prerequisite: GEOG3122
Examples of applications of geographical information systems in resources and environmental management and urban and regional analysis. Case studies include the monitoring of land degradation, management of biological and physical resources, environmental conflict resolution, administration of land records, provision of health services, transport and land use planning, marketing and territory assignment. Visits to inspect facilities and activities of key government agencies are included.

GEOG3152
Social Welfare and Urban Development
Staff Contact: Dr S. Walker (A/Prof I. Burnley)
S1 L2 T2
Prerequisite: GEOG2092 or GEOG3202. This prerequisite does not apply to students enrolled in course 3010.
A consideration of welfare aspects of urban development, including social policies and urban structure; social costs and benefits of urban renewal especially in the inner city; growth centres and new towns; distributional aspects of social services; and spatial disparities in social well-being.

GEOG3161
Computer Mapping and Data Display
Staff Contact: Prof B.J. Garner
S1 L1 T3
Prerequisites: Successful completion of a Year 1 program in Science or Arts or equivalent as approved by Head of School
Introduction to theoretical and practical problems in displaying data graphically and constructing thematic maps by computer using the GIMMS mapping package. The emphasis is on developing skills in automated cartography through hands-on experience culminating in the preparation of a folio of maps of selected census data. No previous computing expertise is required.
GEOG3172
Spatial Population Analysis
Staff Contact: A/Prof I. Burnley
S2 L2 T2
Prerequisite: GEOG3202
Population growth and structure in an international urban and regional context. The components and processes of population change; fertility, mortality and migration set within the framework of demographic transition and development theory. Theories of migration and mobility and of optimal populations. Demographic and social indicators for urban and regional analysis and their implications for inequalities in living conditions, at local, regional, and international scales. The adjustment of immigrant and migrant populations to the urban environment.

GEOG3181
Urban Activity Systems
Staff Contact: Dr B. Parolin
S1 L2 T2
Prerequisite: GEOG3202
Focus is on trip making, movement, and activity patterns in urban areas. Topics include: the activity concept, travel behaviour and urban spatial structure; constraints to individual travel behaviour and activity pattern linkages; the urban transport disadvantaged; public transport problems and issues in Australian capital cities; travel and activity consequences of transport infrastructure developments.

GEOG3192
Urban and Regional Development
Staff Contact: Dr M. Sant
S2 L2 T2
Focus is on the growing importance of recreation and tourism in urban and regional systems. Emphasis is on problems of land use and resource allocation and implications for planning in Australia. Theoretical and practical studies of leisure environments, open space provision, recreational demand, methods of forecasting, management of supply, resort development, economic and environmental impact assessment.

GEOG3211
Australian Environment and Natural Resources
Staff Contact: A/Prof M. Fox and Dr I. Prosser
S2 L2 T2
Prerequisite: GEOG1051 or GEOG1031
The characteristics of Australia’s physical and biotic environment: geology, climate, geomorphology, soils, vegetation and fauna. The problems of exploiting Australia’s water and land resources including the degradation of land by erosion, salinisation and soil fertility decline; and habitat loss and fragmentation.

GEOG3221
Advanced Geographic Methods
Staff Contact: Dr S. Walker
S1 L2 T2
Prerequisite: GEOG2093
Note/s: Excluded GEOG2013.
Additional quantitative research techniques normally taken by Honours students in their third year. Research organization; computer analysis; collection and organization of data; statistical description; hypothesis testing and sampling; simple and multiple association analysis; nonparametric methods.

GEOG3333
Special Topic
Staff Contact: School Office
F T4
Admission by permission to suitable students with good Passes in at least four subjects at Upper Level. A course of individually supervised reading and assignments as an approved topic in Geography not otherwise offered.

GEOG3334
Special Research Methods
Staff Contact: A/Professor I. Burnley
F T2
Prerequisite: A graded pass average in at least four upper level geography subjects
Note/s: Excluded GEOG3333
A course of individually supervised readings leading towards an advanced understanding of theoretical and analytical developments in one area of geography.

GEOG4010
Field Project 4
Staff Contact: Dr W. Erskine
S2 T8
Develop skills in problem formulation and team-based field work. Preparation and presentation of professional quality reports of applied geographical analysis. Define problem, plan strategy for appropriate investigation. Conduct field studies, and report results of investigation. Field work of five days is compulsory. Students will incur some personal expenses in connection with this subject.

GEOG4031
Project
Staff Contact: School Office
S1 T16
Prerequisite: GEOG3082
Implementation of the research proposal in Applied Geography prepared for GEOG3082 Project Design and Formulation under the direction of a supervisor; preparation of a project report.

GEOG4100/GEOG4050
Honours Geography
Staff Contact: A/Prof I. Burnley (Arts) & Mr A. Evans (Science)
F
Prerequisites: Arts students must satisfy Faculty requirements for entry to the Honours Level program and must have obtained at least 54 credit points in Geography subjects, including 12 Level 1 credit points. A minimum cumulative average at Credit level is required for all Upper Level subjects taken which must include GEOG3221.
Details of Honours Geography for science students are available from the School of Geography office
Students are required: 1. To undertake an original piece of work extending throughout the year and to submit a thesis based upon it. 2. To participate in seminars and fieldwork as notified by the School of Geography.

GEOG4042
Practical Applications in Geography
Staff Contact: Dr P. Simons
S1 T3
Seminars with practitioners in the fields of urban and regional analysis and environmental studies, including environmental impact statements; research proposals; report writing; the roles of government agencies and consultants; and budgeting for research projects; applying for positions and personal skills development.

GEOG4052
Advanced Spatial Analysis
Staff Contact: Dr S. Walker
S2 L2 T2

Selected topics in economic and physical geography chosen to illustrate developments at the frontiers of research in spatial analysis.

GEOG4062
Advanced Environmental Analysis
Staff Contact: A/Prof M. Melville
S2 L2 T2

Selected topics in the study of human and physical environments, chosen to illustrate contemporary frontiers of research and development in environmental studies.
Graduate Study

Course Outlines

8024
Graduate Program in Geographic Information Systems

Master of Applied Science
MAppSc

The Masters degree program in Geographic Information Systems is offered in both Geography and Geology within the Faculty of Applied Science. Entry into either discipline depends on the background of the applicant and the orientation of the proposed program.

Entry qualifications. Four-year Honours degree of appropriate standard in Geography, Geology, Surveying, or a relevant environmental science.

Course requirements. Candidates are required to complete a course totalling 30 credits made up of compulsory subjects, elective subjects and a project. The degree will normally comprise one year of full-time study or two years of part-time study.

Compulsory Subjects

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Subject Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>GEOG9240</td>
<td>Principles of Geographic Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>and either</td>
<td>GEOG9241</td>
<td>3</td>
</tr>
<tr>
<td>or SURV9604</td>
<td>Land Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>and one of the following</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOG9280</td>
<td>Applications and Management of GIS*</td>
<td>3</td>
</tr>
<tr>
<td>or GEOG9330</td>
<td>Spatial Data/Processing and Integration*</td>
<td>3</td>
</tr>
<tr>
<td>and either</td>
<td>GEOG9509</td>
<td>9</td>
</tr>
<tr>
<td>or GEOG9512</td>
<td>Project</td>
<td>12</td>
</tr>
</tbody>
</table>

Note: Other subjects may be substituted for those listed with permission of the Course Coordinator to suit the specific needs of individual students.

* Students wishing to include both of these subjects should take one as an elective.

Graduate Programs in Rangeland Management

General

The University has considerable experience of research and teaching relating to the management of arid zone rangelands, gained over many years by several of its schools. This experience is now used in the provision of these graduate programs based at the University campus in Kensington, Sydney, but also providing for the use of its field station resources including Fowlers Gap Arid Zone Research Station in western New South Wales.

Programs by coursework are available leading to the award of:

Master of Applied Science in Rangeland Management Course 8025
Graduate Diploma in Rangeland Management Course 5025

Entry qualifications. Masters degree course - Four-year degree at an appropriate standard in an appropriate discipline. Graduate Diploma course - Three-year degree from an approved university or qualifications deemed appropriate by the Faculty of Applied Science.

Course requirements. Candidates are required to complete a program totalling 30 credits for the Masters degree or 24 credits for the Graduate Diploma during one year of full-time study or two years of part-time study. Students will be expected to devote an additional 15 hours per week outside lectures to independent study, fieldwork and completion of assignments.

Course structure. All students are required to complete the core of compulsory subjects which for the Masters degree includes a 9 credit Project. Students then complete the requirements for their Course by selecting the appropriate number of credits from the list of available subjects. Additional subjects may be selected with the permission of the Course Coordinator. In this way students have the flexibility to tailor the course to suit their individual needs.
8025
Rangeland Management Graduate Course

Master of Applied Science
MAppSc

Compulsory Subjects

<table>
<thead>
<tr>
<th>Subject</th>
<th>Credits</th>
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<tbody>
<tr>
<td>WOOL5213 Range Management</td>
<td>3</td>
</tr>
<tr>
<td>GEOG9320 Soil degradation and Conservation</td>
<td>3</td>
</tr>
<tr>
<td>GEOG9509 Project or</td>
<td>3</td>
</tr>
<tr>
<td>WOOL5223 Project</td>
<td>9</td>
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</tbody>
</table>

Optional Subjects

Choose subjects totalling 15 credits from the following list:

- BIOS3014 Ecological Studies in Arid Lands Management 3
- CIVL9842 Groundwater Hydrology 3
- CIVL9875 Hydrological Processes 3
- ECON2109 Economics of Natural Resources 3
- GEOG9150 Remote Sensing Applications 3
- GEOG9240 Principles of Geographic Information Systems 3
- GEOG9310 River Management 3
- GEOG9330 Soil Studies for Arid Lands Management 3
- GEOG9300 Vegetation Management 3
- WOOL5113 Livestock Production 12

Additional subjects may be substituted with the permission of the Course Coordinator.

5025
Rangeland Management Graduate Diploma Course

Graduate Diploma
GradDip

Compulsory Subjects

<table>
<thead>
<tr>
<th>Subject</th>
<th>Credits</th>
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<tr>
<td>GEOG9320 Soil Degradation and Conservation</td>
<td>3</td>
</tr>
<tr>
<td>WOOL5213 Range Management</td>
<td>3</td>
</tr>
</tbody>
</table>

Optional Subjects

Choose subjects totalling 18 credits, to include at least 9 credits of graduate level subjects.

- CIVL9842 Groundwater Hydrology 3
- CIVL9875 Hydrological Processes 3
- WOOL2103 Livestock Production 1* 6
- WOOL3111 Livestock Production 2* 3
- WOOL3203 Pastoral Agronomy* 6
- WOOL4113 Livestock Production 3* 6
- WOOL5113 Livestock Production 12
- ECON2109 Economics of Natural Resources* 3
- GEOG3021 Biogeography* 3

Additional subjects may be substituted with the permission of the Course Coordinator.

Graduate Programs in Remote Sensing

Programs are available leading to the award of:
- Master of Applied Science in Remote Sensing Course 8026
- Graduate Diploma in Remote Sensing Course 5026

8026
Remote Sensing Graduate Course

Master of Applied Science
MAppSc

The masters degree program in Remote Sensing is offered in both the Faculty of Applied Science and the Faculty of Engineering. Entry into either Faculty depends on the background of the applicant and the orientation of the proposed program.

Entry qualifications. Four-year degree of appropriate standard in engineering, geography, geology, surveying, or in a relevant environmental biological or agricultural science.

Course requirements. Candidates are required to complete a course totalling 30 credits, made up of compulsory subjects, electives, and a project. Compulsory subjects not offered in a particular year may be substituted by an equivalent subject, approved by the appropriate Course Coordinator. The degree will normally comprise one year of full-time study or two years of part-time study.

Compulsory Subjects

<table>
<thead>
<tr>
<th>Subject</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOG2021 Introduction to Remote Sensing*</td>
<td>3</td>
</tr>
<tr>
<td>GEOG3051 Soils and Landforms*</td>
<td>3</td>
</tr>
<tr>
<td>GEOG3062 Environmental Change*</td>
<td>3</td>
</tr>
<tr>
<td>GEOG9240 Principles of Geographic Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>GEOG9130 Soil Studies for Arid Lands Management</td>
<td>3</td>
</tr>
<tr>
<td>GEOG9300 Vegetation Management</td>
<td>3</td>
</tr>
<tr>
<td>GEOG9310 River Management</td>
<td>3</td>
</tr>
<tr>
<td>BIOS3014 Ecological Studies in Arid Lands Management</td>
<td>3</td>
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</tbody>
</table>
Elective Subjects

GEOG9210 Computer Mapping and Data Display 3
GEOG9220 Principles of Geographical Information Systems 3
GEOG9241 Advanced Geographical Information Systems 3
GEOG9250 Special Topic 3
GEOG9280 Applications and Management of GIS 3
GEOL0110 Geological Remote Sensing* 3
GEOL0310 Image Processing of Spatial Data Sets 3
GEOL0360 Remote Sensing Applications in Geoscience 3
SURV9532 Data Acquisitions and Terrain Modelling 3
SURV9602 Remote Sensing Procedures 3
SURV9605 Ground Investigations for Remote Sensing 3
SURV9606 Microwave Remote Sensing 3

* Students who take GEOL0110 are precluded from taking GEOL0310 and GEOL0360.

Note: Other subjects may be substituted for those listed with permission of the Course Coordinator to suit the specific needs of individual students.

Graduate Programs in Environmental Studies

5026 Remote Sensing Graduate Diploma Course

Graduate Diploma GradDip

The graduate diploma program in Remote Sensing is offered in both the Faculty of Applied Science and the Faculty of Engineering. Entry into either faculty depends on the background of the applicant and the orientation of the proposed program.

Entry qualifications. Three-year degree from an approved university and or qualifications deemed appropriate by the relevant faculty.

Course requirements. Candidates are required to complete a program totalling 24 credits or equivalent to 12 hours per week for two sessions of full-time study, made up of compulsory subjects (12 credits) and elective subjects (12 credits). Compulsory subjects not offered in a particular year may be substituted by an approved equivalent subject.

The course will normally comprise one year of full-time study or two years part-time study. One-third of the credits for elective subjects may be from approved undergraduate subjects.

Compulsory Subjects

SURV9600 Principles of Remote Sensing 3
SURV9605 Ground Investigations for Remote Sensing 3
GEOG9150 Remote Sensing Applications 3
GEOG9290 Image Analysis in Remote Sensing 3

8045 Master of Environmental Studies MEnvStudies

This is an interdisciplinary course designed to study the nature of environmental problems and the methodology of evaluation. Emphasis is placed on the development of relevant skills in environmental analysis, management and planning.

Entry qualifications. Four-year Honours degree, or equivalent, in a field relevant to environmental studies.

Course requirements. Candidates are required to complete a course totalling 30 credits made up of compulsory subjects, elective subjects and a project. The degree will normally comprise one year of full-time study or two years of part-time study.

See Entry Under Safety Science

8046 Environmental Management

Master of Applied Science MAppSc

The Masters degree program in environmental management provides an opportunity to focus on the management of key natural resources, particularly soils,
rivers, and vegetation. Emphasis is also placed on the application of information technology for planning and decision making.

Entry qualifications. Four year degree of appropriate standard in geography, environmental science, engineering, or in a relevant biological or agricultural science.

Course requirements. Candidates are required to complete a course of study totalling 30 credits made up of compulsory subjects (9 credits), a project (9 credits), and elective subjects (12 credits). Compulsory subjects not available in a particular year may be substituted by an equivalent subject, approved by the Course Coordinator. The degree will normally comprise one year of full-time study or two years of part-time study. Students will be expected to devote an additional 15 hours per week outside lectures and practical classes to independent study, fieldwork, and completion of assignments.

Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter "Handbook Guide", appearing earlier in this book.

GEOG9120
Settlement in Australia: Development and Change
Staff Contact: Dr S. Walker
C3 S2 L2
Problems and issues relating to urbanization in Australia. External influences on urban planning in Australia, and subsequent modifications to urban structure, pattern of settlement, displacement and the role of immigration. Planned developments of growth centres; settlements in remote areas and differential urban growth. Socio-economic issues relating to inner city redevelopment and urban consolidation; outer suburban locations; and critical perspectives on the relationship between population density, housing conditions and behaviour patterns.

GEOG9130
Soil Studies for Arid Lands Management
Staff Contact: A/Prof M. Melville
C3 S1 or S2 L2 T4
Soil forming processes in arid regions. Physical, mineralological and chemical characteristics of arid soils, with emphasis on properties significant for land capability. Chemical and physical properties of saline and alkali soils. Soil response to irrigation, secondary salinization and alkalinization. Classifications and distribution of arid zone soils and their environmental relationships. Field methods and soils survey techniques, statistical analysis of soil data and its application to mapping. Laboratory analyses of physical and chemical characteristics of soils, with emphasis on properties significant for land capability.

Compulsory subjects

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Units</th>
</tr>
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<tbody>
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Elective Subjects*

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*Alternative subjects may be substituted approved by the Course Coordinator.

Based on GEOG3011 Pedology, with additional reading, tutorials, seminars and practical classes to stress the features of arid zone soils. The formal component of the above teaching is completed at Kensington. However, a number of tutorial and laboratory hours are devoted to a field-based soil mapping project based at Fowlers Gap Research Station.

GEOG9150
Remote Sensing Applications
Staff Contact: Drs A. Skidmore, Q. Zhou & Mr A. Evans
C3 S1 L1 T2
The application of remotely-sensed data and information in the description, classification and assessment of earth resources and environmental conditions. Different types of remote sensing data and imagery, their attributes, acquisition and uses. Relevance of remote-sensing data and imagery to a range of applications, including assessment of conditions of terrain, soils and surface materials; multitemporal monitoring and inventory of rangelands, croplands and forests; rural and urban land use assessment; surveillance of surface water resources and sedimentation; appraisal of changes in the coastal zone. Use of remote sensing in environmental management and in environmental impact assessment.

GEOG9160
Directed Problems in Remote Sensing
Staff Contact: Dr A. Skidmore
C3 S2 T3
A detailed investigation of a particular aspect of remote sensing technology or an area of applications relevant to candidates interests and background.
GEOG9180
Environmental Planning and Evaluation
Staff Contact: Dr M. Sant
C2 S1
Seminars on environmental problems, socio-economic assessment of policies and proposed developments, resource management.

GEOG9210
Computer Mapping and Data Display
Staff Contact: Prof B. Garner
C3 S1 L2 T2
Introduction to automated cartography and thematic mapping; theoretical and practical problems in displaying and mapping data by computer; review and application of selected computer mapping packages. INFO is used for database management, and ARCINFO and GIMMS for cartographic manipulation and output.

GEOG9230
Population, Health and Environment
Staff Contact: A/Prof I. Burnley
C3 S2
Relationship between environmental factors and disease morbidity and mortality is examined by consideration of the epidemiological transition in different countries, and the spatial and occupational-specific variation in disease incidence in Australia. Methodology for standardising, testing for significance and data quality.

GEOG9240
Principles of Geographic Information Systems
Staff Contact: Dr Q. Zhou
C3 S1 L1 T3
Study of selected geographic information systems; problems of data capture and display, data storage and manipulation, system design and development; cartographic displays and computer mapping. INFO is used for database management, and ARCINFO and MAP for spatial data manipulation and display.

GEOG9241
Advanced Geographical Information Systems
Staff Contact: Dr A. Skidmore
C3 S1 L1 T2
Prerequisite: GEOG9240
Advanced topics and concepts in GIS research and development. Focus is primarily on vector-based systems. Topics include data models, structures and capture; vector editing and algorithms; errors and data accuracy. Practical exercises based on ARCINFO; INFO is used for data base management.

GEOG9250
Special Topic
Staff Contact: Dr M. Sant
C3 S1 or S2 T3
Selected topics may be pursued in the forum of individually supervised readings and assignments linked to studies in postgraduate programs offered through the School of Geography.

GEOG9280
Application and Management of Geographical Information Systems
Staff Contact: Dr A. Skidmore
C3 S2 L2 T1
The process and issues involved in an organisation acquiring, implementing and managing a GIS will be considered using real examples. Applications using GIS in the management of natural resources (forest, park, soil etc), utilities and cadastra at the local, national and global scale will be critically reviewed. The course will involve the practical use of project management tools and the application of GIS to solve a management problem using ARCINFO or MAP. INFO is used for database management.

GEOG9290
Image Analysis of Remote Sensing
Staff Contact: Drs A. Skidmore & Mr A. Evans
C3 S1 L1 T1
Techniques for extracting information from satellite imagery including image enhancement techniques, classification and feature recognition, statistical methods, and related procedures. Emphasis is on applications relating to vegetation cover and natural resource management. Practical work will be undertaken using the ERDAS image processing software.

GEOG9300
Vegetation management
Staff Contact: A/Prof J. Dodson, A/Prof M. Fox & Dr A. Skidmore
C3 S1 L2 T1
Note/s: Fieldwork forms a compulsory part of this subject and students will incur personal costs.

The subject provides a background in theory and practice in vegetation management, particularly under Australian conditions. It covers the description and measurement of vegetation, vegetation dynamics, vegetation response to perturbation and human impacts, theories, and modelling of vegetation change. A third of the subject is devoted to management strategies of selected vegetation types.

GEOG9310
River management
Staff Contact: Dr W. Erksine
C3 S1 L2 T1
Note/s: Fieldwork forms a compulsory part of this subject and students will incur personal costs.

The principles of river management including total or integrated catchment management, environmental impact assessment, instream uses and hydrogeomorphic behaviour. Issues covered include regulated rivers, interbasin diversions, extractive industries, urbanisation, river engineering, legislative controls and institutional responsibilities. The course develops an understanding of how and why rivers respond to human activities and ways of ameliorating negative impacts. Field work is an essential part of the subject and the Nepean River will be used as a case study of management problems.

GEOG9320
Soil Degradation and Conservation
Staff Contact: A/Prof M. Melville and Dr W. Erksine
C3 S2 L2 T1
Note/s: Fieldwork forms a compulsory part of this subject and students will incur personal costs.

Identification, assessment and analysis of the main processes of soil degradation, including the role of climate, vegetation, geomorphology and pedology in controlling the processes. Discussions of appropriate management strategies for reducing degradation and for reclaiming degraded landscapes. Topics include: surface wash, gully erosion, wind erosion, soil acidification, soil structure decline, salinisation, accumulation of toxins and desertification.

GEOG9330
Spatial Data Processing and Integration
Staff Contact: Dr Q. Zhou
C3 S1 L1 T2

Geographical information systems and remote sensing have many similarities, including geometric rectification, incorporation of reference data into the analysis of GIS and remotely sensed data, accuracy assessment, the form and structure of the data, visual analysis of spatial data and digital processing methods (Boolean overlay, decision support systems, affined transformations and expert systems). These topics will be considered and applied in the laboratory using remotely sensed and GIS data. INFO is used for database management and ARCINFO, ERDAS and MAP to demonstrate the practical application of the topics.

GEOG9509
Project
Staff Contact: Dr A. Skidmore
C9 S2 T9

A practical application or investigation in environmental studies or in land classification as a basis for land management or landuse planning; or an investigation of soil degradation in relation to soil-vegetation characteristics and land use; or a comparative review of existing approaches to land evaluation. Involves preparation of a report, and fieldwork at Fowlers Gap Research Station or in another part of arid or semi-arid Australia. Tutorial hours are equivalent contact hours, but also involve fieldwork out of session.

GEOG9512
Project
Staff Contact: Drs M. Sant and A. Skidmore
C12

An investigation of a problem in remote sensing or geographical information systems which involves an identifiable research component. Such an investigation should be related to the research interests of particular Schools within the Faculty of Applied Science.
At the basis of most of the technological advances of recent years, the explosion in new highly sophisticated materials is transforming everything in our manufactured environment, from the humble set of scissors to jet aircraft and America’s Cup yachts. New advanced ceramics — lighter, harder and more stable at high temperatures than any metal — are finding applications in motor vehicle engines, electronic components and surgical implants. Manufacturers are looking to these and other sophisticated materials to meet the demands of the new high tech industries (such as lasers, electronics and fibre optics), or in the quest for enhanced fuel economy, durability or fabrication streamlining in their products.

Materials Science has been designated as a primary area for increased investment by the Federal Government in order to meet the expected growth of the materials industry in Australia, particularly in the more sophisticated applications such as electronic and electrical ceramics, high temperature materials, surface coatings, machine tool materials and engineering polymers. Increases in the number of graduates and postgraduates are anticipated over the coming decade. In addition, if Australia is to be competitive in the area of advanced materials, the manufacturing industry in this country will have to be developed and restructured, and this can be expected also to create new positions for materials graduates.

The School of Materials Science and Engineering is in a good position to provide the increased numbers of graduates necessary for development of these new initiatives in materials. It is the only school in Australia which offers professional courses in ceramic engineering, metallurgical engineering, and materials engineering as well as providing postgraduate specialization in these fields. The School is extremely well equipped with a wide range of advanced computing, thermal analysis, mechanical testing, X-ray, optical and electron microscopy facilities.

The School comprises three departments, ceramic, materials, and metallurgical engineering which offer the above-mentioned undergraduate courses.

Ceramic Engineering and Ceramics

The ceramic industry produces an enormous volume and variety of products used in engineering applications, building construction and in our everyday life. As well as the traditional bricks, roof tiles, sheet and container glass and tableware, ceramics have been found essential as abrasives, refractories, enamels and in electrical and electronic applications and nuclear fuels. In many of these cases, ceramic articles make possible the manufacture of other products either by being a key component, such as an electronic or magnetic part, or by forming the material of construction of, for example, a blast furnace or an abrasive wheel. Modern ceramics comprise such a varied and complex group of materials that a high level of training is required to control their manufacture with the required precision and to supervise their proper use. Ceramic engineers are needed in increasing numbers both in Australia and overseas countries and the School offers the only degree course in Ceramic Engineering in Australasia.

The Ceramic Engineering course trains students in the relation between the structure and the properties of ceramic materials, the engineering and process chemistry of their manufacture and the design principles of their use. Careers open to graduates fall into three broad categories. Some
The undergraduate courses in metallurgical engineering and metallurgy are broadly based on engineering and physical sciences and have been designed to prepare graduates for employment in any field of metallurgy within the metal and manufacturing industries or in research institutions.

Graduates in Metallurgical Engineering are eligible for membership of the Institution of Engineers, Australia, the Australasian Institute of Mining and Metallurgy and the Institution of Metals and Materials Australasia.

Students are required to have gained at least sixteen weeks of approved industrial experience before graduation, and to have submitted satisfactory reports on such work. Industrial experience is usually obtained during the long recess periods.

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**Materials Engineering**

Materials Engineering is a new and broad-ranging discipline which applies the principles of science and engineering to the design and development of metallic, ceramic and plastic materials and, to their manufacture into goods and their subsequent performance in service. It is founded on the relationship between structure and properties, an understanding of which, permits materials to be engineered to specific end use requirements. Virtually every manmade material is now the subject of study of the Materials Engineer.

Due to an increasing demand for optimised materials, graduates in Materials Engineering are presented with an outstanding range of job opportunities. Many graduates pursue an industrial career either in the materials producing industries, the utilities, or manufacturing sector. Materials and process development and selection, supervision of manufacturing and production processes technical trouble shooting and testing, are areas in which Materials Engineers are commonly engaged. Alternatively, graduates may pursue a research career, working in laboratories run by materials producing companies, and statutory commonwealth government departments. Graduates with an organising ability frequently move into management both in industry and research. Since materials engineering is a broadly-based scientific/engineering discipline, there is considerable flexibility in career selection.

Graduates in Materials Engineering are eligible for membership of the Institution of Engineers, Australia.

Students are required to have gained at least twelve weeks of professionally oriented or industrial experience in an area of industrial setting involving processing, production, characterisation, analysis, testing etc.
# Undergraduate Study

## Course Outlines

### Ceramic Engineering and Ceramics

A four-year full-time course in Ceramic Engineering leading to the award of the BE degree, and a six-year part-time course in Ceramics leading to the award of the BSc (Tech) degree, are offered within the School.

### 3025

#### Ceramic Engineering - Full-time Course

**Bachelor of Engineering**  
**BE**

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†This subject and others in the professional program, contribute towards satisfaction of the Category C General Education requirement.
Ceramic Engineering - Part-time Course

Bachelor of Science Technology
BScTech

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Metallurgical Engineering

A four-year full-time course in metallurgical engineering leading to the award of the BMetE degree (Physical Metallurgy or Process Metallurgy Major) and a six-year part-time course in metallurgy leading to the award of the BSc(Tech) degree are offered within the School.

Metallurgical Engineering - Full-time Course

Bachelor of Metallurgical Engineering
BMetE

Students entering the Bachelor Metallurgical Engineering program may elect to major in either Process Metallurgy or Physical Metallurgy. Selection of these alternative study programs may be deferred until the end of the second year of full-time study.

The Process Metallurgy option is designed to produce graduates with training appropriate to the primary metallurgy industry while the Physical Metallurgy option provides a training more suited to the manufacturing industry.

Year 1 of the course consists of physics, chemistry, mathematics and engineering subjects and is essentially the same as that for a number of other engineering and science courses offered in the Faculty of Applied Science. Year 2 introduces Materials Science and Materials Engineering subjects supported by chemistry and mathematics and is common with Year 2 in the full-time Ceramic Engineering and Materials Engineering Courses. Physical Metallurgy and Metallurgical Engineering are introduced in Years 3 and 4. In Year 3 the major strands are supported by other engineering subjects and in Year 4 by a thesis project, seminar and professional electives.

Students are required to have gained at least sixteen weeks of approved industrial experience before graduation, and to have submitted satisfactory reports on such work. Industrial experience is usually obtained during the long recess periods at the ends of Years 2 and 3. During the
## Undergraduate Study Mats 93

### Introduction to Materials Industry
- Introduction to Materials Industry: 2 units
- Introduction to Materials Engineering: 1 unit
- Introduction to Computing: 0 units

### Engineering Statics
- Engineering Statics: 0 units
- Engineering Drawing and Descriptive Geometry: 4 units

### Mathematics
- Mathematics 1: 6 units
- Mathematics 2: 6 units

### Chemistry
- Chemistry 1: 6 units

### Physics
- Physics 1: 6 units

---

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**Total Units:** 25

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**Total Units:** 22

### Year 3 (Physical Metallurgy Major)

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**Total Units:** 25

### Year 3 (Process Metallurgy Major)

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**Total Units:** 24

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**Total Units:** 26

### Year 4 (Process Metallurgy Major)

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**Total Units:** 26

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*Students who have completed two years' study at an approved tertiary institution are exempted from Category A.

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*This subject and others in the professional program contribute towards satisfaction of the Category C General Education requirement.

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* A list of Professional Electives will be made available at the end of the Year 3 program and choices for the following year arrived at.
Metallurgy - Part-time Course

Bachelor of Science (Technology)
BSc(Tech)

This course is designed for students who are employed in the metallurgical and manufacturing industries and extends over six part-time years of study. Some of the subjects of stages 3, 4, 5 and 6 may be available only in daytime classes, and up to one day of release from industry per week may be required. The course essentially covers the same subject matter as the first three years and part of Year 4 of the full-time Metallurgical Engineering course and involves the same major strands of study in Physical Metallurgy and Metallurgical Engineering. The course has recently been revised. In the later stages of the course, there is less emphasis on primary metallurgy than in the full-time course and there is more emphasis on secondary Metallurgical Engineering which is developed to Year 4 level, while Physical Metallurgy is taken to Year 3 level. Students are required to complete an approved program of industrial training of not less than twelve months prior to the award of the degree. Industrial training should normally be completed concurrently with attendance in the course, but with approval of the Head of School may be completed after completion of the prescribed course of study.

Materials Engineering

A four-year full-time course in materials engineering leading to the award of the BMatE degree is offered within the School.
### Materials Engineering - Full-time Course

**Bachelor of Materials Engineering**

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### Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

**APSE0002**

**Social Issues in Applied Science**

*Staff Contact: A/Prof C.C. Sorrell*

S1 L1 T2

The subject covers social issues arising from future technological developments and the role that a professional applied scientist can play in influencing future directions. It will be taught by a combination of group activity, case studies and projects and seminars from visiting speakers, some of whom will be from disciplines other than the applied sciences.

**MATS1001**

**Introduction to the Materials Industry**

*Staff Contact: A/Prof C.C. Sorrell*

S1 L1 T1

The role of materials science and engineering in industry. Engineering materials. Information retrieval. Communication skills. Plant visits. Introductory materials science. Structure and properties of main types of engineering materials with emphasis on the ways in which properties may be controlled by controlling structure.

**MATS1002**

**Microstructural Analysis**

*Staff Contact: Dr P. Krauklis*

S1 L1 T2

MATS1011
Introduction to Materials Engineering
Staff Contact: Dr A. G. Crosky
S1 L1
Metals, ceramics, polymers and composites, their structure, chemical, physical and mechanical properties, engineering applications and production with particular reference to Australian industries.

MATS1021
Introduction to Computing
Staff Contact: Dr A. K. Hellier
S2 L2
Introductory computing. Outline of computer architecture. Features of common computing languages; syntax, structure, variable typing, portability. Basic syntax. Common numerical techniques, function evaluation, Monte Carlo techniques; assignments involving application of these techniques.

MATS1022
Materials Process Principles
Staff Contact: School Office
S2 L0.5 T0.5
Introduction to engineering calculations. Material balances. Techniques for solving problems, including selection of a basis for calculations, use of tie elements and recycle calculations. General energy balances. Unsteady-state material and energy balances. Examples are drawn from ceramic, materials and metallurgical engineering practices.

MATS1032
Materials Engineering 1A
Staff Contact: School Office
S2 L1 T2.5
Fluid flow in materials processing. Application of the principles of fluid flow in the production and application of ceramic and metallic materials. Subject examples are drawn from ceramic, materials and metallurgical engineering practice in the broadest sense.

MATS1042
Crystallography and XRay Diffraction
Staff Contact: Dr P. Munroe
S1 L2 T2

MATS1043
Heat, Fluid and Mass Flow in Materials Processing
Staff Contact: School Office
S1 L2 T1

MATS1052
Materials Engineering 1B
Staff Contact: School Office
S2 L1 T2.5
Heat applications of principles of steady and unsteady heat transfer in the production and application of materials. Course examples are drawn from materials engineering practice in the broadest sense. Heat flow in materials processing involving high temperature solid, liquid and gaseous phases. Thermal properties of dense and porous materials. Heat treatment, casting, sintering, corrosion, etc. Computer programs for calculating heat flow in materials.

MATS1062
Mechanical Properties of Materials
Staff Contact: Dr P. Krauklis
S1 L2 T2
Prerequisite: MECH0130
Mechanical properties of solids. Nature and significance of mechanical properties. Mechanical testing; the tension test, hardness testing and impact testing. Stress-strain-time relationships. Analysis of stress and strain, stress and strain transformation relationships, Mohr’s circle, elastic stress-strain relationships, application to various types of loading and metal working processes. Failure and yielding criteria. Influence of stress state, temperature, strain rate and environment on mechanical behaviour.

MATS1072
Physics of Materials
Staff Contact: Dr A.K. Hellier
S1 L2 T1
Prerequisite: PHYS1002
Interatomic bonding in solid materials. Types of interatomic bonds, metallic, covalent, ionic. Introductory quantum mechanics in one dimension, free electron theory, effects of periodic potential, density of states curves. Effect of electron to atom ratio on conductivity and crystal structure; semiconductors; intrinsic, extrinsic. Exchange energy; ferromagnetism, antiferromagnetism. Elementary perturbation theory, covalent bond; crystal structures, properties. Ionic bond, force models, properties.

MATS1082
Thermodynamics of Materials 1
Staff Contact: School Office
S2 L2 T1

MATS1083
Nonferrous Alloys
Staff Contact: Dr P. Krauklis
S2 L1 T2

MATS1092
Materials and Design 1
Staff Contact: Dr. A. G. Crosky
S2 L1 T1
An appreciation of the relationships between the properties of materials, component design, manufacturing and product performance. Materials selection as an integral part of successful design. Long term potential for materials improvement and substitution. Plant visits to selected materials processing plants.

MATS1093
Thermodynamics of Materials 2
Staff Contact: Dr. O. Ostrovski
S1 L2

MATS1102
Numerical Methods
Staff Contact: Dr. A. K. Hellier
F L1 T.5
Prerequisite: MATS1021
Finite difference and finite element techniques and their application to materials phenomena involving heat transfer, elasticity and plasticity.

MATS1112
Phase Equilibria
Staff Contact: School Office
S2 L1 T1

MATS1113
Ceramic Process Principles 1
Staff Contact: Mr. S. Prokopovich
S1 L2
The nature of ceramics. The scope of the ceramic industry, and principal unit operations. Particle packing: two, three and multi-component systems. Principal unit operations used in the ceramic industry. Drying and firing of ceramics. Glass and other melt forming processes. Hot forming and miscellaneous forming methods.

MATS1154
Advanced Materials Unit 1 Magnetic Materials
Staff Contact: Dr. S. Blair
S1 or S2 L1

Unit 2 Heat Resisting Alloys
Staff Contact: Prof. D. J. Young
S1 or S2 L1

Unit 3 Fibre Reinforced Composites
Staff Contact: Dr. A. G. Crosky
S1 or S2 L.5
Fibre composites, fibre and matrix materials, fabrication. Design with fibre composites. Mechanical properties and environmental effects, corrosion, fatigue, creep and damage tolerance.

Unit 4 Titanium alloys
Staff Contact: Dr. P. Munroe
S1 or S2 L.5

MATS1163
Chemistry of the Solid State
Staff Contact: A/Prof. C. C. Sorrell
S1 L2
Crystal chemistry; nature of bonding in solids, ionic, and silicate structures; and structure-composition relationships. Glass and glass-ceramics. Reaction with solids, grain boundary and interfacial effects, ceramic reactions and polymorphic transformations (oxides, nonoxides, alumino-silicates).

MATS1164
Welding Science and Technology
Unit 1 Welding Technology
Staff Contact: Dr. A. G. Crosky
S1 or S2 L1
Fusion welding and allied processed. Capabilities, advantages and limitations.

Unit 2 Welding Metallurgy
Staff Contact: Dr. A. G. Crosky
S1 or S2 L1 T1
Metallurgical aspects of fusion welding and allied processes. Cause of welding defects and weldability of carbon and alloy steels, stainless steels, aluminium and other common nonferrous alloys. Assessment of welds by mechanical testing and non-destructive methods.

MATS1203
Materials and Design 2
Unit 1 Design for Corrosion Control
Staff Contact: Prof. D. J. Young
S1 L1 T1
Electrochemical corrosion, types of corrosion, influence of alloying and heat treatment, influence of stress. Corrosion
prevention, cathodic protection, passivation and inhibitors, selection of materials, designing against corrosion.

Unit 2 Surface Treatment and Wear  
*Staff Contact: Dr P. Krauklis*
S2 L1 T1


**MATS1244**  
Management  
*Staff Contact: Mr S. Prokopovich*
S1 or S2 L4

The major issues, research findings and management strategies relating to the human side of enterprise. Topics include management and power, leadership and innovation, managerial decision-making, stress at work, group dynamics and intergroup conflict, organisational design, goal setting and performance appraisal, approaches to personal and organisational development. Marketing and sales; marketing research, marketing strategies, customer relations, total product package. Project management: project planning and scheduling, contract planning and control, recent developments.

**MATS1253**  
Ferrous Alloys  
*Staff Contact: Dr P. Krauklis*
S2 L1 T2


**MATS1254**  
Design Project  
*Staff Contact: Dr S. Bandyopadhyay*
F L0.25 T1.75

This project will cover the design of a selected piece of processing equipment or an engineering component. It will involve selection and specification of materials and other relevant aspects covered within the undergraduate course.

**MATS1263**  
Alloy Steels  
*Staff Contact: Dr P. Krauklis*
S2 L1 T1


**MATS1294**  
Electrical Ceramics  
*Staff Contact: Dr S. Blairs*
S1 or S2 L1 T2


**MATS1464**  
Materials Seminar  
*Staff Contact: A/Prof C.C. Sorrell*
F T2

Demonstration of public speaking skills and techniques. Preparation of visual aids. Library usage. Preparation and standards of written material. Chairpersonship. Each student is required to make two oral presentations based on the honours project.

**MATS1534**  
Design with Brittle Materials  
*Staff Contact: School Office*
S1 L1.5 T1.5


**MATS2123**  
Ceramic Process Principles 2  
*Staff Contact: Mr S.A. Prokopovich*
S2 L2


**MATS2133**  
Ceramic Raw Materials  
*Staff Contact: Mr S.A. Prokopovich*
S1 L2

The geological origin of ceramic raw materials. The minerals, mineralogical composition, properties and uses of commercial clays. The sources, physical properties and uses of non-clay raw materials.

**MATS2143**  
Ceramic Equipment  
*Staff Contact: Mr S.A. Prokopovich*
S2 L3

The principles of operation, construction and fields of application of equipment used in the ceramic industry in the following areas: mining and beneficiation; preparation of raw materials and auxiliary processing operations; forming, drying and firing of ceramic products.
MATS2153
Ceramic Processing Laboratory
Staff Contact: Mr S.A. Prokopovich
FT3
Laboratory programme illustrating processing and engineering aspects of ceramic technology. Students are required to take part in a series of factory inspections.

MATS2183
Refractories
Staff Contact: A/Prof C.C. Sorrell
S2 L2
Classification of refractories. Chemical and physical properties of refractories. Introduction to raw materials and manufacturing technology. A detailed study of chemical reactions occurring between refractories and solid, liquid and gas phases in ferrous and nonferrous metal industry. Review of phase equilibria.

MATS2193
Origins of Microstructure
Unit 1 Phase Equilibria
Staff Contact: Dr A.G. Crosky
S1 L1 T1

Unit 2 Diffusion
Staff Contact: Dr A.K. Hellier
S1 L1 T1

MATS2203
PhysicoChemical Ceramics Laboratory
Staff Contact: A/Prof C.C. Sorrell
S1 T3 S2 T4
Laboratory programme illustrating the physical and chemical properties associated with the processing and performance of ceramic materials. Students are required to take part in a series of factory inspections.

MATS2244
Ceramic Process Engineering
Staff Contact: Mr S.A. Prokopovich
S1 L2

MATS2254
Ceramic Engineering Design
Staff Contact: Mr S.A. Prokopovich
S2 L2
Engineering aspects of ceramic processing. Ceramic engineering design including design of dryers, kilns and glass tanks. Case studies. Pollution control equipment.

MATS2264
Sintering of Ceramics
Staff Contact: A/Prof C.C. Sorrell
S1 L1.5 T.5

MATS2273
Chemistry of Ceramic Processes
Staff Contact: A/Prof C.C. Sorrell
S2 L2
High-temperature reactions involving clays, silicates, oxides, and nonoxides. Processing effects of calcining, chemical reaction and vitreous and crystalline bond formation. Chemical and physical aspects of production of whitewares, porcelain, heavy clay products, glass, cements, cermets, and advanced high-purity ceramics.

MATS2274
Mechanical Properties of Ceramics
Staff Contact: School Office
S2 L2

MATS2284
Thermal Properties of Ceramics
Staff Contact: A/Prof C.C. Sorrell
S2 L2

MATS2304
Project (Ceramic Engineering)
Staff Contact: School Office
F T6
An experimental or technical investigation or design related to some aspects of ceramic engineering.

MATS2324
Materials and Design 3
Unit 1 Fracture Mechanics
Staff Contact: Dr A.K. Hellier
S1 or S2 L1 T1
Brief review of theory of elasticity. Brittle fracture and strength theories. Quantitative design against fracture in

MATS3223
Mechanical Behaviour of Materials (Units 1, 2, 4, & 5)
Unit 1 Deformation
Staff Contact: Dr. P. Munroe
S1 L2
Atomic and molecular description of deformation. Introduction to dislocation theory and its application of mechanical properties. Chain dynamics under stress.

Unit 2 Fractographic Analysis
Staff Contact: Dr. A.G. Crosby
S2 L1 T1
Classification of macroscopic and microscopic fracture mechanisms. Initiation and propagation of ductile, brittle, fatigue, creep, stress corrosion, and corrosion fatigue fractures. Effect of material defects, design deficiencies and incorrect processing on the origin and cause of fracture. Analysis of various modes of fracture using fractographic techniques involving optical microscopy and scanning and transmission electron microscopy.

Unit 4 Metal forming processes
Staff Contact: Dr. A.G. Crosby
S1 L1 T1

Unit 5 Polymer forming processes
Staff Contact: Dr. S. Bandyopadhyay
S2 L1
Industrially significant manufacturing processes.

MATS3324
Materials and Design 3 (Units 1 & 2)
Unit 1 Fracture Mechanics
Staff Contact: Dr. A. K. Hellier
S1 or S2 L1 T1

MATS3443
Polymer Science and Engineering
Staff Contact: Dr. S. Bandyopadhyay
S2 L4 T2

MATS3484
Welding Science and Technology
Unit 1 Welding Technology
Staff Contact: Dr. A.G. Crosky
S1 or S2 L1
Fusion welding and allied processes. Capabilities, advantages and limitations.

MATS3524
Materials Engineering Project
Staff Contact: Dr. A.G. Crosky
F6
An experimental or technical investigation or design related to some aspects of materials engineering.

MATS3544
Polymer Engineering
Staff Contact: Dr. S. Bandyopadhyay
F L2 T1

MATS4104
Metallurgy Project/Metallurgical Engineering Project
Staff Contact: Dr. A.G. Crosky
F6
An experimental investigation of some aspects of metallurgy or metallurgical engineering.

MATS4144
Mechanical and Thermal Processing of Materials
Unit 1 Deformation and Forming of Sheet Metal
Staff Contact: Dr. A.G. Crosky
S1 or S2 L1

Unit 2 Powder Metallurgy
Staff Contact: School Office
S1 or S2 L1
MATS4174
Staff Contact: Dr S. Bandyopadhyay
S1 or S2 L.5 T.5
Metal Matrix Composites (MMC) - their advantages and scope. Potential applications, limitations. Various systems of MMC's: role of interfaces. Fabrication techniques. Mechanical and Fracture Properties. Effect of volume fraction and size, size distributions and shape of reinforcement. Other properties such as creep, fatigue, corrosion, machinability.

MATS4204
Industrial Metallurgy Project
Staff Contact: Dr A.G. Crosky
F3
An experimental investigation of some aspect of industrial metallurgy.

MATS4223
Mechanical Behaviour of Materials (Units 1, 2, 3, 4, 6 & 7)
Unit 1 Deformation
S1 L2
Staff Contact: Dr P. Munroe
Atomic and molecular description of deformation. Introduction to dislocation theory and its application to mechanical properties. Chain dynamics under stress.

Unit 2 Fractographic Analysis
S2 L1 T1
Staff Contact: Dr A.G. Crosky
Classification of macroscopic and microscopic fracture mechanisms. Initiation and propagation of ductile, brittle, fatigue, creep, stress corrosion, and corrosion fatigue fractures. Effect of material defects, design deficiencies and incorrect processing on the origin and cause of fracture. Analysis of various modes of fracture using fractographic techniques involving optical microscopy and scanning and transmission electron microscopy.

Unit 3 Deformation and Strengthening Mechanisms
Staff Contact: Dr B. Gleeson
S2 L1 T1
Strengthening mechanisms, creep, fracture, grain size dependence of strength. Introduction to generation of deformation and recrystallization textures. Measurements of age-hardening, activation energy of strain ageing.

Unit 4 Metal Forming Processes
Staff Contact: Dr A.G. Crosky
S1 L1 T1

Unit 6 Quality Assurance and Control
Staff Contact: Dr A.G. Crosky
S2 L1

Unit 7 Advanced Fractographic Analysis
Staff Contact: Dr A.G. Crosky
S2 L.5 T.5
Extension of fractographic analysis to include creep, hydrogen embrittlement and corrosion fatigue. Analysis of service failures using metallographic and fractographic techniques.

MATS4324
Materials and Design 3
Unit 1 Fracture Mechanics
Staff Contact: Dr A. K. Hellier
S1 or S2 L1 T1

Unit 3 Design for Welding
Staff Contact: Dr A.G. Crosky
S1 or S2 L1 T1
Design of welded fabrications to reduce distortion and the risk of failure by fatigue, brittle fracture, etc. Welding application codes, weld quality requirements and quality assurance with welded fabrication.

MATS4363
Origins of Microstructure (Units 1,2,3,4)
Unit 1 Phase Equilibria
Staff Contact: Dr A.G. Crosky
S1 L1 T1

Unit 2 Diffusion
Staff Contact: Dr A.K. Hellier
S1 L1 T1

Unit 3 Metallography and Phase Equilibrium Laboratory
Staff Contact: Dr A.G. Crosky
S1 T3

Unit 4 Phase Transformations
Staff Contact: Dr B. Gleeson
S2 L2 T1
MATS4463
Origins of Microstructure Double Degree and BSc(Tech) (Units 1,2,3)
Unit 1 Phase Equilibria
Staff Contact: Dr A.G. Crosky
S1 L1 T1


Unit 2 Diffusion
Staff Contact: Dr A.K. Hellier
S1 L1 T1


Unit 3 Metallography and Phase Equilibrium Laboratory
Staff Contact: Dr A.G. Crosky
S1 T3


MATS5203
Origins of Microstructure
Unit 1 Phase Equilibria
Staff Contact: Dr A.G. Crosky
S1 L1 T1


MATS5213
Metallurgical Plant Practice
Staff Contact: School Office
S1 or S2 T2.5

Up to 3 days of metallurgical plant inspections and case studies equivalent to 35 tutorial hours are associated with this subject. Ferrous and non-ferrous plant practice.

MATS5223
Mechanical Behaviour of Materials
Unit 4 Metal forming Processes
Staff Contact: Dr A.G. Crosky
S1 L1 T1


MATS5224
Mechanical Behaviour of Materials
Unit 6 Quality Assurance and Control
Staff Contact: Dr A.G. Crosky
S1 or S2 L1


MATS5253
Metallurgical Reaction Engineering
Staff Contact: Dr O. Ostrovski
S1 or S2 L2


MATS5263
Extractive Metallurgy
Staff Contact: School Office
S1 L2 S2 L2 T3

A review of the unit operations used in the iron and steel industry, sintering, pulverisation, iron blast furnace, desulphurisation, steelmaking, deoxidation and ladle metallurgy, direct reduction, plasma developments, mini steel plant. Unit operations for the treatment of non-ferrous minerals, roasting, sintering, smelting, refining and electrowinning.

Application of principles of aqueous thermodynamics, electrochemistry, chemical and electrochemical kinetics to hydrometallurgical processes: leaching of mineral and concentrates, solution purification, precipitation, and other separation processes, ion-exchange and liquid-liquid extraction, electrowinning and electrodissolution.

MATS5314
Kinetics and Mass Transfer in Metallurgical Processes
Staff Contact: Dr A. Yu
S1 L1 S2 L2 T1


MATS5324
Modelling Metallurgical Processes
Staff Contact: Dr A. Yu
S2 L3 T1

The mathematical and physical modelling of primary and secondary metals processing operations. Ladle metallurgy operations, entrainment of gases by molten metals, electromagnetically driven flows, dispersion of alloying additions, coalescence of inclusions, modelling metal flow and solidification, blast furnace drainage, mathematical plasticity, estimation of stresses developed during industrial deformation processes, rolling, drawing, bending.
MATS5384
Air Pollution Control in the Metallurgical Industry
Staff Contact: School Office
S1 or S2 L5 T.5
Case studies of emission surveys, measurements and compliance program planning in the primary and secondary metallurgical industries.

MATS7134
Structure and Properties of Metallurgical Phases
Unit 1 Structure and Properties of Solids
Staff Contact: School Office
S1 or S2 L1 T1
Application of defect solid state chemistry to materials preparation and reactivity. Non-stoichiometric and stoichiometric-dependent physical and chemical properties of metal compounds.

Unit 2 Structure and Properties of Melts
Staff Contact: School Office
S1 or S2 L1
The atomistic and microscopic approach to melts in process metallurgy, liquid metals, mattes, molten salts and slags. Relationships between melt structure, mechanism and reaction kinetics in smelting and refining operations.

MATS7144
Mechanical and Thermal Processing of Materials
Unit 2 Powder Metallurgy
Staff Contact: Dr M. Edisninghe
S1 or S2 L1

MATS7154
Advanced Materials
Unit 1 Magnetic Materials
Staff Contact: School Office
S1 or S2 L1

Unit 2 Heat Resisting Alloys
Staff Contact: Prof D.J. Young
S1 or S2 L1

MATS7164
Welding Science and Technology Unit Welding Metallurgy
Staff Contact: Dr A.G. Crosky
S1 or S2 L1 T1
Metallurgical aspects of fusion welding and allied processes. Causes of welding defects and weldability of carbon and alloy steels, stainless steels, aluminium and other common non-ferrous alloys. Assessment of welds by mechanical testing and non-destructive methods.

MATS7223
Mechanical Behaviour of Materials (Units 1, 3 & 4A)
Unit 1 Deformation
Staff Contact: Dr P. Munroe
S1 L2
Atomic and molecular description of deformation. Introduction to dislocation theory and its application to mechanical properties. Chain dynamics under stress.

Unit 2 Fractographic Analysis
Staff Contact: Dr A.G. Crosky
S2 L1 T1
Classification of macroscopic and microscopic fracture mechanisms. Initiation and propagation of ductile, brittle, fatigue, creep, stress corrosion, and corrosion fatigue fractures. Effect of material defects, design deficiencies and incorrect processing on the origin and cause of fracture. Analysis of various modes of fracture using fractographic techniques involving optical microscopy and scanning transmission electron microscopy.

Unit 3 Deformation and Strengthening Mechanisms
Staff Contact: Dr B. Gleeson
S2 L1 T1
Strengthening mechanisms, creep, fracture, grain size dependence of strength. Introduction to generation of deformation and recrystallization textures. Measurements of age-hardening, activation energy of strain ageing.

Unit 4 (Part of) Metal Forming Processes
Staff Contact: Dr A.G. Crosky
S1 L1 T1

MATS7244
Advanced Electron Optics
Staff Contact: Dr P. Munroe
S1 or S2 L1 T1
See School for details.

MATS7384
Air Pollution Control in the Metallurgical Industry
Staff Contact: School Office
S1 or S2 L5 T.5
Case studies of emission surveys, measurements and compliance program planning in the primary and secondary metallurgical industries.

MATS7470
Polymer Processing and Fabrication
Staff Contact: Dr S. Bandyopadhyay
S1 L2 T2
Factors affecting quality and efficiency of extrusion, injection moulding and other fabrication techniques. Polymer viscous flow; viscometry; fluid flow and heat transfer in melt processing. Effect of polymer chemical structure, temperature and molecular weight upon flow
properties. Computer simulation of polymer flow during processing.

MATS7480
Polymer Product Design
Staff Contact: School Office
S2 L2


MATS7490
High Temperature Techniques
Staff Contact: School Office
S1 or S2 L1

Experimental methods for the determination of thermophysical and thermochemical properties at elevated temperatures.

MATS7500
Mathematical Plasticity
Staff Contact: Dr A.K. Hellier
S1 or S2 L1

Mathematical approaches to macroscopic plastic deformation; slip line field analysis, upper and lower bound techniques, finite element techniques. Application to estimation of loads and stresses developed during industrial deformation processes: rolling, drawing, bending.

MATS8193
Origins of Microstructure
Unit 1 Phase Equilibria
Staff Contact: Dr A.G. Crosky
S1 L1 T1


Unit 2 Diffusion
Staff Contact: Dr A.K. Hellier
S1 L1 T1


Unit 3 Metallography and Phase Equilibrium Laboratory
Staff Contact: Dr A.G. Crosky
S1 T3


MATS9223
Mechanical Behaviour of Materials (Units 1,2,3,7)
Unit 1 Deformation
Staff Contact: Dr P. Munroe
S1 L2

Atomic and molecular description of deformation. Introduction to dislocation theory and its application to mechanical properties. Chain dynamics under stress.

Unit 2 Fractographic analysis
Staff Contact: Dr A.G. Crosky
S2 L1 T1

Classification of macroscopic and microscopic fracture mechanisms. Initiation and propagation of ductile, brittle, fatigue, creep, stress corrosion, and corrosion fatigue fractures. Effect of material defects, design deficiencies and incorrect processing on the origin and cause of fracture. Analysis of various modes of fracture using fractographic techniques involving optical microscopy and scanning and transmission electron microscopy.

Unit 3 Deformation and strengthening mechanisms
Staff Contact: Dr B. Gleeson
S2 L1 T1

Strengthening mechanisms, creep, fracture, grain size dependence of strength. Introduction to generation of deformation and recrystallization textures. Measurements of age-hardening, activation energy of strain ageing.

Unit 7 Advanced fractographic analysis
Staff Contact: Dr A.G. Crosky
S2 L5 T5

Extension of fractographic analysis to include creep, hydrogen embrittlement and corrosion fatigue. Analysis of service failures using metallographic and fractographic techniques.

MATS9323
Mechanical Behaviour of Materials (Units 1,2,3)
Unit 1 Deformation
Staff Contact: Dr P. Munroe
S1 L2

Atomic and molecular description of deformation. Introduction to dislocation theory and its application to mechanical properties. Chain dynamics under stress.

Unit 2 Fractographic Analysis
Staff Contact: Dr A.G. Crosky
S2 L1 T1

Classification of macroscopic and microscopic fracture mechanisms. Initiation and propagation of ductile, brittle, fatigue, creep, stress corrosion, and corrosion fatigue fractures. Effect of material defects, design deficiencies and incorrect processing on the origin and cause of fracture. Analysis of various modes of fracture using fractographic techniques involving optical microscopy and scanning and transmission electron microscopy.
Unit 3 Deformation and Strengthening Mechanisms
Staff Contact: Dr B. Gleeson
S2 L1 T1
Strengthening mechanisms, creep, fracture, grain size dependence of strength. Introduction to generation of deformation and recrystallization textures. Measurements of age-hardening, activation energy of strain ageing.

MATS9420
Materials for Mining Engineers
Staff Contact: Dr P. Krauklis
F L2 T1

MATS9520
Engineering Materials
Staff Contact: Dr A.G. Crosky
S1 L2 T1
Microstructure and structure-property relationships of the main types of engineering materials (Metals, Ceramics, Polymers and Composites). Micromechanisms of elastic and plastic deformation. Fracture mechanisms for ductile, brittle, creep and fatigue modes of failure in service; corrosion. Metal forming by casting and wrought processes. Phase Equilibria of alloys; microstructural control by thermomechanical processing and application to commercial engineering materials. Laboratory and tutorial work includes experiments on cast and recrystallised structures, ferrous and non-ferrous microstructures and fracture and failure analysis.

MATS9530
Materials Engineering
Staff Contact: A/Prof C.C. Sorrell
S1 or S2 L2 T1
Prerequisite: MATS9520
Materials used in Mechanical Engineering and related fields (Manufacturing Engineering Management, Aerospace Engineering, Naval Architecture) are discussed with emphasis on the dependence of properties and performance on microstructure. Aspects of materials selection during the design of engineering components which affect the service performance in applications where failure can occur by brittle fracture, corrosion, creep or fatigue, will also be discussed.

MATS9640
Materials Science and Engineering for Electrical Engineers
Staff Contact: School Office
S2 L3 T1
Metallic, ceramic, organic, polymeric and composite materials and their technology for electrical engineering applications. Structures and structure property relations, phase equilibria and their effect on mechanical, electrical, magnetic, thermal and chemical properties. The shaping, treating and joining of materials. Aqueous and gaseous corrosion. Metallic glasses, superconductors, fast ion conductors. The role of materials science in the development of electrical energy systems.

MATS9650
Pyrometallurgical Processes
Staff Contact: School Office
S1 L2
The application of thermodynamics to the understanding of pyrometallurgical processes and a review of the unit operations, roasting, sintering, smelting and refining for the treatment of ferrous and non-ferrous minerals.
The School welcomes enquiries from graduates in Science, Engineering and Applied Science who are interested in doing research leading to the award of the degrees of Master of Science, or Doctor of Philosophy in metallurgy or ceramic engineering or who are interested in programs involving formal course work and research leading to the award of Master of Applied Science in Engineering Materials or Master of Applied Science in Corrosion Engineering.

Information about research scholarships, fellowships and grants in-aid is available from the Head of School and graduates are advised to consult him before making a formal application for registration.

**Elective Subjects**

Additional subjects are chosen from those offered by the School of Materials Science and Engineering, or from those offered by other Schools; in the University subject to approval by the Head of School. Full details of all subjects are listed in the University calendar and handbooks. Depending on the candidate’s background, enrolment in a limited number of undergraduate subjects may be appropriate, but may not exceed 15% of the non-project component. In all cases, the total of the compulsory core, project and elective subjects will be a minimum of 18 hours per week.

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### Compulsory Core

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<th>Course Description</th>
<th>HPW</th>
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<td>Major Graduate Materials Project</td>
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**UNSW graduates who have done MATS9542 (4.952, 5.4222), CIVL2402 (8.240) AND/OR MATS9530 (4.913), CIVL4403 (8.440) must substitute other appropriate subjects approved by the Head of School of Materials Science and Engineering.
Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult the Staff Contact. A guide to abbreviations and prefixes is included in the chapter ‘Handbook Guide’ earlier in this book.

MATS1092
Materials and Design 1
Staff Contact: School Office
S2 L1 T1
An appreciation of the relationships between the properties of materials, component design, manufacturing, and product performance. Materials selection as an integral part of successful design. Long term potential for materials improvement and substitution. Plant visits to successful materials processing plants.

MATS6005
Corrosion Project
Staff Contact: School Office
F HPW6
A substantial project on some aspect of corrosion science or technology.

MATS6203
Materials and Design 2
Unit 1 Design for corrosion control (Unit 1 of MATS1203)
Staff Contact: Prof D.J. Young
S1 L1 T1

MATS6405
Graduate Materials Seminar
Staff Contact: School Office
F HPW2
Instruction in written or oral presentation of technical and scientific material at an advanced level which involves a presentation by the candidate of a lecture on a selected topic.

MATS6475
Materials Science and Engineering
Staff Contact: School Office
F L2 T1
development of materials for specific engineering applications. Appropriate laboratory and tutorial work.

MATS6485
Materials Technology
Staff Contact: School Office
F L1.5 T1.5

MATS6495
Corrosion Materials
Staff Contact: School Office
F L2 T1
Properties and efficient selection of materials for corrosion resistance. Applications in manufacturing, mining and process industries, in transportation equipment, and in structures. Materials selection for service in particular environments.

MATS6505
Industrial Coatings for Corrosion Protection
Staff Contact: School Office
S1 L2
Special topics on heavyduty organic, inorganic and metallic coatings using in atmospheric, marine and industrial environments.

MATS6545
Corrosion Technology
Staff Contact: School Office
F L3
Environmental fracture; corrosion in specific environments; corrosion of specific equipment types; principles of materials selection and design; surface preparation and maintenance coatings; polymeric materials and linings, inhibitors and electrochemical tests methods; cathodic protection.

MATS6555
Minor Graduate Materials Project
Staff Contact: School Office
F HPW3
A small technical investigation or a design project, including a written report.

MATS6565
Major Graduate Materials Project
Staff Contact: School Office
F HPW9
A substantial experimental or theoretical investigation, or design project, including a written thesis.
School of Mines

Head of School
Associate Professor G.R. Taylor

The School of Mines, which was formed in 1986, consists of two Departments and two Centres corresponding to the main professions on which the mining and minerals industry of Australia depends. These are the Departments of Applied Geology and Mining Engineering, and the Centre for Minerals Engineering (in conjunction with the School of Chemical Engineering) and the Key Centre for Mines.

Prior to the formation of the School of Mines, Applied Geology and Mining Engineering were separate Schools and Mineral Processing and Extractive Metallurgy (referred to as Mineral Engineering) was spread among several other Schools in the Faculty. Bringing the three together into the School of Mines is an important development in mining industry education in Australia.

Geologists, Mining Engineers and Minerals Engineers work closely together in the mining industry. The Geologist is responsible for discovering new mineral resources and for defining the size, value and condition of the deposit. The Mining Engineer decides if the deposit is worth mining, designs the mine and thereafter manages it throughout its life. The Minerals Engineer deals with these resources after they have been mined, and designs and manages the large plants needed to turn the crude ore into metal or the raw coal into saleable fuel.

Each is an expert in her or his own field, but each also needs to have a good appreciation of the work of the other two. Professional roles in the mining industry are not always clear cut and it is a distinct advantage for geologists, mining engineers and minerals engineers to study and interact together while at University, in preparation for their necessarily close involvement with each other during their professional careers.

Separate degree courses are available in each, as described below. Students enrol in the course of their own choice and many activities are departmentally centred, but others are School-based to provide a corporate identity with the mining and allied industries.

**Department of Applied Geology**

**Head of Department**
Associate Professor C.R. Ward

Geology is 'the science of the earth', and as such covers a broad spectrum of knowledge on the constitution and evolution of our planet. Applied Geology involves a specific interest in the use of earth science for the benefit of humanity, including, for example, the search for and evaluation of metallic ore-bodies and accumulations of fossil fuels, or the application of geological knowledge to a range of engineering and environmental problems.

**General Education Electives**
For details of changes in the General Education requirements see Faculty Information

**Department of Mining Engineering**

**Head of Department**
Associate Professor G.C. Sen

Mining Engineering is concerned with the design, development and management of mines for the extraction of the earth's mineral and energy resources. Mining production whether underground, at the surface, offshore or on the sea floor is a technically advanced engineering activity and the mining engineering course caters for the present day and future requirements of the industry. The mining engineer is a front line executive in control of all phases of a mining project from evaluation of a coal or an ore deposit, the planning and development of its extraction, its processing on site, the safe disposal of waste products and the restoration of the environment during and after mining.
Most mining engineers are trained for careers in mine production and management and their engineering and managerial roles necessitate liaison with a range of experts, from those engaged in exploration geology, to those in end-product development and marketing. The mining engineering course involves a strong grounding in basic sciences, engineering principles and management as a foundation to training for the production and mine management functions. The course also provides a good appreciation of the science of geology, the technology of mineral processing and the economics of resources so that the mining engineer can effectively work in any section of the mining industry from evaluation of ore reserves to marketing and finance.

The mining engineer's training has an appeal to many other industries in that it combines excellence in a broad range of disciplines from science and engineering to economics of management of human resources. With such a background, mining engineers can easily adapt to work in almost any industry either on graduation or at a later stage in their career.

After graduation, mining engineers who choose to develop careers in production management, will be required to gain further practical experience before obtaining a Mine Managers Certificate of Competency, in either Coal or Metalliferous Mining. These statutory certificates of competency are issued by the State Department of Industrial Relations, which in the case of New South Wales coal mining comes under the Coal Mines Regulation Act No. 67, 1982, and for metalliferous mining under the Mines Inspection Act No. 75, 1901, as amended. Arrangements have been made with the Universities of Newcastle and Tasmania for students who have completed a specified program at these institutions to be admitted with advanced standing to Year 3 of the Mining Engineering degree course at the University of New South Wales.

Centre for Minerals Engineering

Director
Dr T. Tran

Students wishing to specialise in Minerals Engineering enrol in the BE course in Chemical Engineering in years 1 and 2, and undertake studies in Minerals Engineering in years 3 and 4 as professional electives in this degree.

For details of subjects offered, please see the course outline for Course 3040 in the Chemical Engineering section.

General Education Electives

For details of changes in the General Education requirements see Faculty Information

Key Centre for Mines

Director:
Associate Professor G.R. Taylor

The Key Centre is a joint initiative of the Universities of New South Wales and Wollongong. Funded by the Department of Employment, Education and Training. The purpose of the Key Centre for Mines is to provide a full range of educational and research services to the minerals Industries.

Particular emphasis is being placed on continuing education, distance learning and industry based research and development.

The industry sector being addressed by the Key Centre for Mines covers the exploration, extraction, and primary processing of mineral resources.

Undergraduate Study

Course Outlines

Department of Applied Geology

The Applied Geology course provides a comprehensive education in all aspects of earth science. It leads to the award of a Bachelor of Science (BSc) degree over four years full-time study, with honours for students who perform with merit throughout the course program.

Students learn the fundamental principles of geology through lectures, laboratory work, projects and field tutorials. At the same time they gain the practical skill and knowledge of geological applications necessary for employment in research, industry or government. Graduates are prepared by the course to enter any branch of the geological profession, or to undertake further studies leading to a Higher degree. They are also well equipped to change their field of employment as different opportunities arise.

No previous knowledge of geology is required to enter this course but a sound background in mathematics together with at least one other science subject is essential. Students who have not undertaken chemistry at HSC level are advised to take chemistry at the introductory level in Year 1, this incurs no extension to the duration of the
course. Students, who have reached a satisfactory standard in HSC Geology may be offered an alternative program in Year 1.

Reciprocal courses are offered through the Board of Studies in Science and Mathematics in Geology (double major), Geophysics, Earth and Environmental Science and courses that combine a single major in Geology with Physics, Chemistry, Mathematics or Botany and Zoology. These courses are all of three years full-time duration leading to a BSc at Pass level. An optional fourth year leading to Honours is available for students of high academic standing.

### 3000

**Applied Geology - Full-time**

**Bachelor of Science**

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<th>Year</th>
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<tr>
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<td>CHEM1002 Chemistry 1 or Introductory Chemistry</td>
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<td>MATH1021 General Mathematics 1C</td>
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<td></td>
<td>PHYS1002 Physics 1 or Introductory Physics or</td>
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<td>GEOL2011 Mineralogy and Igneous Petrology</td>
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<td>GEOL2031 Sedimentology and Palaeontology</td>
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<td>GEOL2022 Petrology and Structural Geology</td>
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<td>GEOL2041 Geological Computing</td>
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<td>GEOL2051 Introductory Geophysics</td>
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### Department of Mining Engineering

The Department offers a 4 year full-time course in Mining Engineering leading to the award of the degree of Bachelor of Engineering at Pass or Honours level.

**Bachelor of Engineering**

**BE**

Year 1 of the course is similar to that of several other Engineering courses and Year 2 includes those subjects of common relevance to the Engineering disciplines. Year 3 is largely devoted to basic mining subjects and Year 4 provides advanced instruction in subjects essential to all mining engineers. In addition, the fourth year offers a wide range of elective subjects, allowing students, if they so wish, to concentrate their studies on a particular sector of the industry, such as coal mining or metalliferous mining. An important fourth year requirement is for students to undertake personal research or a study project in mining or minerals engineering on which they are required to submit a thesis for examination.

For the award of Honours at the conclusion of the full-time course, students will need to have distinguished themselves in the formal work, in other assignments as directed by the Head of Department, and in the final year project.
In the undergraduate course it is compulsory for students to gain practical experience in the mining industry during successive long recesses. The minimum requirement is 100 days which must be completed before graduation. The School assists students in securing suitable vacation employment. Students are required to submit for assessment an industrial training report on the vacation and other relevant experience acquired.

<table>
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<tr>
<th>Course Code</th>
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<td>MINE0010</td>
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<td>MINE0210</td>
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<td>MATS9420</td>
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<td>Fluid Mechanics and Thermodynamics</td>
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<td>Mine Water and Drainage</td>
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<td>Mining of Metalliferous Deposits</td>
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<td>Mining of Coal Deposits</td>
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<td>MINE1231</td>
<td>Rock Mechanics</td>
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<td>Soil Mechanics</td>
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<td>Bulk Materials Handling &amp; Transport</td>
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<td>MINE1530</td>
<td>Power Supply in Mines</td>
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<td>MINE1630</td>
<td>Excavation Engineering (Blasting)*</td>
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<td>MINE1631</td>
<td>Excavation Engineering (Machine Mining)</td>
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<td>MINE1830</td>
<td>Mine Ventilation and Environment</td>
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<td>MINE7342</td>
<td>Minerals Engineering Processes</td>
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<td>SURV0580</td>
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*Visits to mines and related undertakings are requirement for this subject.

** Includes two compulsory field tutorials.

*** These subjects contribute towards the satisfaction of the Category C General Education requirement.

** Advanced Electives **

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<td>MINE7440</td>
<td>Mineral Process Technology</td>
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<td>MINE3140</td>
<td>Computational Methods in Geomechanics</td>
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<td>MINE3240</td>
<td>Operations Research</td>
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**Course Title**: Geotechnical Engineering

**Course Title**: Geology for Mining Engineers 1**

**Course Title**: Geology for Mining Engineers 2**

**Course Title**: Geology for Mining Engineers 3**

**Course Title**: Geology for Mining Engineers 4**
Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organisational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

Department of Applied Geology

Field tutorials are a compulsory part of many of the following subjects and are held during weekends and/or recesses. Dates and personal costs are available during the first week of the subject.

APSE0002
Social Issues in Applied Science
Staff Contact: Applied Geology Office
S1 L1 T1

Social Issues and the Applied Sciences. The subject covers social issues arising from future technological developments and the role that a professional applied scientist can play in influencing future directions. It will be taught by a combination of group activity, case studies and projects and seminars from visiting speakers, some of whom will be from disciplines other than the applied sciences.

GEOL1101
Geological Processes
Staff Contact: Dr M.D. Buck
S1 L3 T2
Prerequisites: HSC Exam Score Range Required - 2 unit Mathematics 55-100, or 3 unit Mathematics 1-50 or 4 unit Mathematics 1-100, and 2 unit Science (Physics) 53-100, or 2 unit Science (Chemistry) 53-100, or 2 unit Science (Geology) 53-100, or 2 unit Science (Biology) 53-100, or 4 unit Science 1-50, or 3 unit Science 90-150
Note/s: Up to 2 days of fieldwork is a compulsory part of this subject. Students will incur personal costs. Details will be provided during the first week of the subject.

Stream 1

or

Stream 2
Available only with permission of the Head of School. A program of projects and independent study of selected aspects of geology. Assessment includes practical and theory examinations.

GEOL1201
Geological Environments
Staff Contact: Dr M.D. Buck
S2 L3 T2
Prerequisites: GEOL1101

Note/s: Up to 4 days of fieldwork is a compulsory part of this subject. Students will incur personal costs. Details will be provided during the first week of the subject.


GEOL2011
Mineralogy & Igneous Petrology
Staff Contact: Dr P.C. Rickwood/ A/Prof B.J. Hensen
S1 L2 T3
Prerequisite: GEOL1201
Note/s: Fieldwork of up to 4 days is a compulsory part of this subject. Students will incur personal costs.


GEOL2022
Petrology & Structural Geology
Staff Contact: A/Prof C.R. Ward/ A/Prof B.J. Hensen/Dr P.G. Lennox
S2 L3 T2
Prerequisite: GEOL2011
Note/s: Fieldwork of up to 4 days, is a compulsory part of this subject. Students will incur personal costs.


GEOL2031
Sedimentology and Palaeontology
Staff Contact: A/Prof C.R. Ward/ Prof J. Roberts
S1 L3 T2
Prerequisite: GEOL1201
Note/s: Fieldwork of up to 5 days is a compulsory part of this subject. Students will incur personal costs.

Sedimentology. Flow regimes and bedding forms, sedimentary structures. Modern and ancient sedimentary environments of deposition: alluvial, near-shore, shelf and deep-sea, in both terrigenous clastic and carbonate/evaporite domains. The facies concept: lateral and vertical relationships between depositional environments and associated lithofacies within developing sediment wedges. Palaeontology. Morphology and geological significance of invertebrates including Foraminifera, Brachiopoda, Mollusca, Coelenterata,
Arthropoda, Protochordata and Echinodermata. Introductory paleobotany, biogeography, ichnology (trace fossils) and biostratigraphy.

**GEOL2041**
**Geological Computing**  
*Staff Contact: Dr D.R. Cohen*  
*S1 L2 T1*  
*Prerequisite: GEOL1101*

Introduction to the use of PC, network and VAX computer systems with emphasis on geological software. Introduction to programming in FORTRAN with statistical applications pertinent to geoscience.

**GEOL2042**
**Geological Statistics**  
*Staff Contact: Dr D.R. Cohen*  
*S2 L2 T1*  
*Prerequisite: GEOL2041*

Introduction to geostatistics, population characterisation and splitting. ANOVA methods, regression analysis, EDA, Markov chains, Analysis of orientated data and processing of spatial geological data.

**GEOL2051**
**Introductory Geophysics**  
*Staff Contact: Mr D. Palmer*  
*S1 L2 T1*  
*Prerequisite: GEOL1101*

Note/s: Fieldwork of up to 5 days is a compulsory part of this subject. Students will incur personal costs.

Principles of gravity, geomagnetism, palaeomagnetism, geothermy and seismology and their relation to shape, internal constitution and dynamic processes of the earth. Introduction to radiometric, gravity and magnetic exploration methods.

**GEOL2062**
**Geological Mapping**  
*Staff Contact: A/Prof A.D. Albani/Mr G. McNally*  
*S2 L2 T2*  
*Prerequisite: GEOL1101 or GEOL1201*


**GEOL2072**
**Environmental Geology**  
*Staff Contact: Prof G. Hocking/A/Prof A.D. Albani/ Dr J. Jankowski*  
*S2 L2 T1*


**GEOL2092**
**Geochemistry**  
*Staff Contact: Dr P.C. Rickwood/Mr P. Atherden*  
*S2 L2 T1*  
*Prerequisite: GEOL1201*


**GEOL3011**
**Mineralogical Techniques**  
*Staff Contact: Dr P.C. Rickwood*  
*S1 L2 T1*  
*Prerequisite: GEOL1201*


**GEOL3021**
**Igneous and Metamorphic Processes**  
*Staff Contact: A/Prof B.J. Hansen*  
*S1 L2 T1.5*  
*Prerequisite: GEOL3011 and GEOL3022*

Note/s: Fieldwork of up to 3 days is a compulsory part of this subject. Students will incur personal costs.


* Pressure, temperature, time-paths and Tectonic setting of metamorphism in the earth's crust.
GEOL3031
Stratigraphy & Basin Analysis
Staff Contact: Prof J. Roberts
S1 L2 T2
Prerequisite: GEOL2031
Note/s: Fieldwork of up to 8 days is a compulsory part of this subject. Students will incur personal costs.


GEOL3052
Exploration Geophysics
Staff Contact: Mr D. Palmer
S2 L2 T1
Prerequisite: GEOL1201
Note/s: Fieldwork of up to 3 days is a compulsory part of this subject. Students will incur personal costs.

Introduction to seismic, electrical and electromagnetic methods of geophysical exploration. Data interpretation and application of these methods for mineral, petroleum, coal and groundwater exploration and engineering projects.

GEOL3072
Engineering Geology
Staff Contact: Prof G. Hocking/Mr G. McNally
S2 L2 T1
Note/s: Fieldwork of up to 2 days is a compulsory part of this subject. Students will incur personal costs.


GEOL3082
Structural Geology
Staff Contact: Dr P.G. Lennox
S2 L2 T1
Prerequisite: GEOL2022
Note/s: Fieldwork of up to 5 days is a compulsory part of this subject. Students will incur personal costs.

Structural Geology. Structural analysis at the microscopic, mesoscopic and macroscopic scales. Structural analysis using Bermagui, Cooma and Broken Hill Terrains. Folds, faults and foliation development. Strain analysis, deformation mechanisms and the relationship between deformation and metamorphism.

GEOL3092
Exploration Geochemistry
Staff Contact: Dr A.C. Dunlop/ Prof G.J.S. Govett/ Dr D.R. Cohen
S2 L2
Prerequisites: GEOL2092 and GEOL3101
Principles and techniques of soil drainage and rock geochemistry as applied to mineral exploration.

GEOL3101
Ore Deposits
Staff Contact: Dr A.C. Dunlop
S1 L3 T2
Prerequisite: GEOL2022
Corequisite: GEOL3011
Note/s: Fieldwork of up to 4 days is a compulsory part of this subject. Students will incur personal costs.

Metallic Resources: Classification and origin of the ore deposits, geochemical processes, research methods. Orhotmagmatic, hydrothermal, porphyry, volcanic, sedimentary, Mississippi Valley type, chromium, iron, manganese ores, residual and mechanical ores. Introduction to mineral exploration. Laboratory study of hand specimens, thin sections and polished sections of various ore types; study of selected mining areas representing various genetic types of ore. Economic Mineralogy. Nature of reflected light. Ore textures and their interpretation. Phase relations and paragenesis of ore minerals. Practical work in optical properties of ore minerals, hardness and reflectivity measurements: study of selected ores and ore minerals under the microscope including textural studies.

GEOL3102
Fossil Fuels & Non-metallic Resources
Staff Contact: A/Prof C.R. Ward
S2 L3 T2
Prerequisites: GEOL2011 and GEOL2031
Note/s: Fieldwork of up to 2 days is a compulsory part of this subject. Students will incur personal costs.


GEOL4111
Advanced Geological Techniques
Staff Contact: Dr P.C. Rickwood/ Dr D.R. Cohen/
A/Prof G.R. Taylor/Dr M.B. Katz
S1 L T6
Note/s: Fieldwork of up to 7 days is a compulsory part of this subject. Students will incur personal costs.

statistics; typical case studies in mathematical geology exemplifying these techniques. Practical work based on microcomputer operating systems, word processing, statistical and graphical packages.

Remote Sensing. Principles of various remote sensing techniques including Landsat and side-looking airborne radar. Techniques of image enhancement and digital processing. Applications of remote sensing in lithological mapping and tectonic analysis. Integration of remotely sensed data with conventional data sources. Practical work with the interactive computer on image analysis with particular reference to student field study areas. Field Work: A compulsory tutorial of up to seven days duration providing training in advanced mapping techniques and in the integrated use of multiple sources of field data.

GEOL4121
Professional Practice
Staff Contact: Prof J. Roberts/Dr A.C. Dunlop
S1 L2 T2
Note/s: Formal classes are scheduled for 13 weeks only to accommodate the field tutorial of GEOL4111.

Project Management: Organisation and costing of geological field programs; land tenure, exploration and mining titles; design of drilling, sampling and analysis programs; integration of geophysical methods; use of geological database and modelling systems; estimation of resources and reserves; reporting requirements, liability and ethics in geological practice. Research and Communication: Literature search and bibliographic indexes; preparation of theses, reports and scientific papers; preparation of maps and other illustrations; presentation of technical material in verbal form; job applications and interview requirements.

GEOL4131
Special Topics in Applied Geology
Staff Contact: Dr P.G. Lennox
S1 HPW8

Instruction by lectures, tutorials and assignments in advanced aspects of a chosen area of geological specialisation. Programs are offered in a number of specialised fields including Mineral Exploration and Mining Geology, Sedimentary Basin Studies, Geophysics and Engineering Geology, Environmental Geology, Geochemistry, Hydrogeology. Details of these programs are available from the Director of Fourth Year studies. The special Topics program would normally be related to the topic of the chosen Field Project (GEOL4203) and is designed to be a preparation for a future career. Variation from the standard programs may be allowed subject to approval from the Head of Department.

GEOL4203
Field Project
Staff Contact: Dr P.G. Lennox
S2 HPW20

Note/s: Students will incur personal costs.

A major field/laboratory project, which generally includes geological mapping, on some aspect of mineral or sedimentary basin resources, engineering or environmental geology or resource geophysics.

Servicing Subjects

These are applied geology subjects taught within courses offered by other faculties.

GEOL4303
Geology Honours
Staff Contact: Dr P.G. Lennox
Note/s: Restricted to program 3970/2500

Students with a double major in geology will follow the program set for Year 4 students in the Faculty of Applied Science course Applied Geology (3000).

GEOL4313
Earth and Environmental Science (Honours)
Staff Contact: A/Prof A.D. Albani
Note/s: Restricted to program 3970/2527

GEOL4323
Earth Environments (Geology)
Staff Contact: A/Prof A.D. Albani
Note/s: Advanced Science only. Restricted to program 3972/6865

GEOL5100
Geology for Civil and Environmental Engineers
Staff Contact: Dr P.G. Lennox
S1 L2 T1

Note/s: Fieldwork of up to 2 days is a compulsory part of this subject. Students will incur personal costs.

An introduction to mineralogy, petrology, structural geology, stratigraphy and geomorphology. Weathering of rocks and development of soils. The role of the geologist in civil and environmental engineering.

GEOL5110
Geology for Landscape Architecture
Staff Contact: A/Prof A.D. Albani

Minerals and rocks. Igneous, sedimentary and metamorphic rocks; their origin and their relationship with the landscape. Geological structures and their graphic representation. Interpretation of geological maps and sections.

GEOL5211
Geology for Mining Engineers 1
Staff Contact: Dr M.B. Katz
F L1 T1

Note/s: Fieldwork of up to 1.5 days is a compulsory part of this subject. Students will incur personal costs.

Main branches of geology and their application to mining. Introduction to mineralogy, petrology, stratigraphy and geomorphology. Rock weathering; Structural geology; faults, folds, joints and foliation. Plate tectonics. The use of geological maps.

GEOL5301
Introduction to Petroleum Geology
Staff Contact: A/Prof C.R. Ward
S1 L1.5 T.5

Note/s: Fieldwork of up to 2 days is a compulsory part of this subject. Students will incur personal costs.

Introduction to earth science, nature and properties of rocks and minerals; sedimentation, sedimentary structures and sedimentary environments; stratigraphy and the geological time scale, geologic maps and structures; introduction to

GEOL5311
Geology for Mining Engineers 2
Staff Contact: Dr M.B. Katz
F  L2  T2
Note/s: Fieldwork of up to 1 day is a compulsory part of this subject. Students will incur personal costs.

Stratigraphy and the use of fossils. Structural Geology including stereographic projection and fracture analysis as applied to mining operations. Origin and properties of coal, oil, oil shale and natural gas. Principles of hydrogeology including the significance of groundwater in mining operations. Mineralogy of important metallic and non-metallic resources, processes of ore formation. Exploration methods.

GEOL5312
Petroleum Geology and Geophysics
Staff Contact: Dr P.G. Lennox/Mr D. Palmer
S2  L2  T1
Prerequisite: GEOL5301
Petroleum Geology: Petroleum generation, including kerogen types and maturation migration, entrapment and degradation; Sedimentary features of reservoir sequences; Structural traps, diapirs and fractured-rock reservoirs, including coal-bed methane; primary and secondary porosity development; exploration techniques and resource evaluation; case studies of selected petroleum fields. Petroleum Geophysics: Fundamentals of seismic wave propagation, seismic data acquisition, seismic data processing, seismic interpretation, three dimensional seismic methods, case studies, vertical seismic profiling.

GEOL5401
Petroleum Production Geology
Staff Contact: A/Prof C.R. Ward
S1  L1  S  T 5
Prerequisite: GEOL5312
Petroleum exploration and development programs; sub-surface maps and sections; geologic characteristics of selected reservoir types; porosity characteristics and recovery effects; coal-bed methane; estimation of petroleum resources.

GEOL5410
Geology for Mineral Engineers
Staff Contact: A/Prof C.R. Ward/Dr M.B. Katz
S2  L2
Nature and properties of coal; methods of testing and analysis; introduction to coal petrology; geological factors in coal preparation and use. Chemical and physical properties of rock forming and economic minerals; introduction to microscope techniques.

GEOL6201
Marine Geology 1
Staff Contact: A/Prof A.D. Albani
F  L1  T2
Prerequisites: GEOL1101 and GEOL1201
Note/s: Field work of 5 days is a compulsory part of the subject. Students will incur personal costs.

Sedimentology. Flow regimes and bedding forms, sedimentary structures. Modern and ancient sedimentary environments of deposition, alluvial, near-shore, shelf and deep sea, in both terrigenous clastic and carbonate/evaporite domains. The facies concept: lateral and vertical relationships between depositional environments and associated lithofacies within developing sediment wedges. Mineralogy and Petrology. Igneous and sedimentary rock types of the ocean floor and their significance.

GEOL6221
Introductory Geophysics
Staff Contact: Mr D. Palmer
S1  L2  T1
Note/s: Excluded GEOL2051. Fieldwork of up to 5 days is a compulsory part of this subject. Students will incur personal costs.

Principles of gravity, geomagnetism, palaeomagnetism, geothermy and seismology and their relation to shape, internal constitution and dynamic processes of the earth. Introduction to radiometric, gravity and magnetic exploration methods.

GEOL6231
Coastal Monitoring Techniques
Staff Contact: A/Prof A.D. Albani
S1  L1  T2
Note/s: Field work of up to 4 days is a compulsory part of the subject. Students will incur personal costs.

General principles of surveying. Optical and electronic methods of distance and elevation measuring. Coastal position fixing. Coordinates systems and their application to coastal mapping. Map projections. Long and short term monitoring of coastal changes. Tides, their measurement and determination of tidal planes. Soundings and bathymetric surveys. Shallow water investigations for seabed and bedrock morphologies. Through its intensive practical approach, the course is designed to give each student an understanding of coastal surveying applicable to a large variety of small scale investigations, from beach to estuarine monitoring.

GEOL6311
Marine Geology 2
Staff Contact: A/Prof A.D. Albani
F  L1  T2
Prerequisite: GEOL6201
GEOL6321
Coastal Environmental Assessment
Staff Contact: A/Prof A.D. Albani
S2 L1 T2
Note/s: Field work of up to 3 days is a compulsory part of the subject. Students will incur personal costs.

The physical nature of the various coastal environments: their morphology and the relationship between water masses and the sedimentary and benthic characteristics of the bottom. Sampling techniques, analytical methodology and statistical data evaluation. Environmental assessment of Australia and overseas areas. An important aspect of the course is its practical approach: from data gathering, data evaluation and environmental assessment report writing. Practical work in the course involves each student as an active member of a project team.

GEOL6330
Exploration Geophysics
Staff Contact: Mr D. Palmer
S2 L2 T1
Note/s: Excluded GEO3052

Geophysics of ocean basins and offshore areas and the techniques of their study. Seismic refraction, reflection and computational methods, instrumentation of seismic and acoustic sources, recording systems and signal processing. Geological and physical interpretation of results. Practical work on instrumentation, recording and interpretation of field data.

GEOL6331
Geochemistry
Staff Contact: Dr P.C. Rickwood/Mr P. Atherden
S2 L2 T1
Prerequisite: GEO1201
Note/s: Excluded GEO2092


GEOL7223
Surficial Constituents
Staff Contact: A/Prof C.R. Ward
F L3 T2
Prerequisite: GEO1101 or GEO1201
Exclusions: GEO2011, GEO2022, GEO3102


GEOL7233
Processes in Environmental Geology
Staff Contact: A/Prof A.D. Albani
F L2 T1
Prerequisites: GEO1101 or GEO1201
Exclusions: GEO2031 and GEO2072


GEOL7321
Geology for Geomorphologists and Pedologists
Staff Contact: A/Prof C.R. Ward
S1 L1 T1 S2 L2 T2
Prerequisites: GEO1201

Markov chains. Analysis of oriented data and processing of spatial geological data.

**GEOL8220**
**Sedimentology**
*Staff Contact: A/Prof C.R. Ward*
*Prerequisite: GEOL1201*
*Note/s: Excluded GEOL2031*

As for Sedimentology in GEOL2031 Sedimentology and Palaeontology.

**GEOL8320**
**Gravity and Magnetic Methods**
*Staff Contact: Mr D. Palmer*
*Prerequisites: PHYS1002 and MATH1032.*
*Note/s: Available only in program 2503. Field work of one day is a compulsory part of the subject. Students will incur personal costs. It is desirable that students taking this unit have a background in geology. Fundamental principles. Field procedures and instruments. Reduction of field data. Regional and residual effects of sources of simple geometrical shapes and generalised two and three-dimensional distributions.*

**GEOL8330**
**Seismic Methods**
*Staff Contact: Mr D. Palmer*
*Prerequisites: PHYS1002 and MATH1032.*
*Note/s: Available only in program 2503. It is desirable that students taking this unit have a background in geology. Field work of one day is a compulsory part of the subject. Students will incur personal costs. Seismic waves. Physical/engineering properties of geological materials. Ray theory in seismic refraction and reflection methods. Instrumentation. Data acquisition and processing. Depth and velocity analysis. Geophysical and geological interpretation. Case history studies.*

**GEOL8340**
**Electrical Methods**
*Staff Contact: Mr D. Palmer*
*Prerequisites: PHYS1002 and MATH1032.*
*Note/s: Available only in program 2503. It is desirable that students taking this unit have a background in geology. Field work of one day is a compulsory part of the subject. Students will incur personal costs. Introductory theory and field practice of resistivity, self-potential, induced polarisation and airborne and ground electromagnetic methods. Geological interpretation of field data. Geophysical logging.*

**GEOL8350**
**Geological Applications**
*Staff Contact: A/Prof C.R. Ward/Dr P.G. Lennox*
*Prerequisite: GEOL1201*
*Note/s: A subject of ten weeks duration. Available only in program 2503. Field work of one day is a compulsory part of the subject. Students will incur personal costs. Structural Geology: Elements of structural geology, stereographic projection and fracture analysis. Geology of Fuels: Origin of coal, oil and natural gas; stratigraphic and structural consideration of oil and coalfields. Hydrogeology: Principles of hydrogeology; transmission of groundwater in rocks and soils.*

**GEOL8360**
**Geophysical and Geological Applications**
*Staff Contact: Mr D. Palmer*
*Prerequisite: GEOL1201*
*Note/s: Excluded GEOL6330. Available only in program 2503.*

characterisation of variability. Modelling multiphase, immiscible fluids, and regional groundwater flow. Applications of modelling to bore-field management, saltwater intrusion, mine dewatering, waste disposal and contaminant transport.

Department of Mining Engineering

APSE0002
Social Issues in Applied Science
Staff Contact: Dr A.K. Bhattacharyya
S1
The subject covers social issues arising from future technological developments and the role that a professional applied scientist can play in influencing future directions. It will be taught by a combination of group activity, case studies and projects and seminars from visiting speakers, some of whom will be from disciplines other than the applied sciences.

MINE010
Applied Mechanics
Staff Contact: Dr J.O. Watson
S1 L2 T1
Statics: definition of force; free body diagrams; static equilibrium of rigid body; statical equivalence of systems of forces; centre of mass, centroid, centre of pressure; friction: clutch, screwjack, belt drive. Kinematics: rectilinear and angular motion; motion in a plane; relative displacement, velocity and acceleration; gear trains and linkages. Dynamics: equations of motion for particle and rigid body; work and energy; impulse, momentum and impact.

MINE0110
Stress Analysis 1
Staff Contact: Dr J.O. Watson
S2 L2 T1
Structures: forces and stresses in pin jointed frames; bending moment, shear force in beams; stress due to bending of beams; deflection of beams; buckling of struts; stress due to torsion of shafts; combined axial and bending stress; stress in thin walled pressure vessels. Stress and strain: definition of stress in three dimensions; stress transformation in two dimensions; principal stresses in two dimensions. Mohr's circle of stress; definition of strain in three dimensions; strain-displacement relations in two dimensions; Mohr's circle of strain; principal strains in two dimensions; electrical and mechanical methods for measurement of strain; isotropic elasticity.

MINE0120
Stress Analysis 2
Staff Contact: Dr J.O. Watson
S1 L2 T1
Prerequisite: MINE0110
Structures: shear stresses in beams; bending moment and shear force in continuous beams; slope-deflection equations and fixed end moments; stiffness matrix and generalised nodal force vector; computer programs for analysis of continuous beams. Stress and strain: stress transformation and principal stresses in three dimensions; strain-displacement relations in three dimensions; strain.

**MINE1140**
Geotechnical Engineering  
*Staff Contact: Dr A.K. Bhattacharyya*  
F L1 T 1  
*Prerequisites: MINE1231, MINE1232*


**MINE1231**  
Rock Mechanics  
*Staff Contact: Dr V.S. Vutukuri*  
S2 L2 T2  
*Prerequisites: MATH1032, MINE0120*


**MINE1232**  
Soil Mechanics  
*Staff Contact: Dr A.K Bhattacharyya*  
S2 L1 T1  
*Prerequisites: MATH1032, MINE0120*

Soil description and classification; engineering behaviour of soils; basic definitions in soil mechanics, effective stress concept; shear strength of soils, soil permeability, flow of water in soils, consolidation, stresses in soil from external loading; design of shallow foundations, compaction, compaction control, pavement and haul-road design, lateral earth pressures, soil slope stability, expansive and dispersive soils, filter design.

**MINE1320**  
Fluid Mechanics and Thermodynamics  
*Staff Contact: Dr A.C. Partridge*  
F L1 T.5  
*Prerequisites: MINE0010, MINE0110, PHYS1002, MATH1032*  
*Corequisite: MATH2001*


**MINE1321**
Mine Water  
*Staff Contact: Dr V.S. Vutukuri*  
S2 L1  
*Corequisite: MINE1320*

Engineering hydrology, sources of mine water, forecasting water inflows, drainage and dewatering, pumps and pumping.

**MINE1330**  
Bulk Materials Handling and Transport  
*Staff Contact: A/Prof G.C. Sen*  
S2 L1.5 T.5  

Transport systems for minerals, waste and supplies. Descriptions and power requirements for: conveyors (belt and chain), rope haulage systems, free steered vehicles and locomotive haulage systems. Descriptions and pressure loss calculations for hydraulic and pneumatic transport systems. Mine winding systems for shafts: mechanics for hoisting; winding cycle diagrams; power requirements. Safety aspects and maintenance programs for haulage and winding systems.

**MINE1420**
Elements of Mining  
*Staff Contact: Mr D. Panich*  
S1 L1  
*Prerequisite: MINE0210*

*Note/s:* Visits to mines and related undertakings are a requirement of this subject.

Exploration. Development of mines, infrastructure requirements; environmental assessment. Ore body parameters for surface and underground mines; stratified and non-stratified deposits; mine layout for surface and underground operations; underground access; introduction of techniques of rock breakage and support for coal and metal mines; processing of minerals; disposal of overburden and rejects rehabilitation.

**MINE1530**
Power Supply in Mines  
*Staff Contact: Dr C.R. Daly*  
S1 L1 T1  
*Prerequisites: MINE0310, MINE1320, PHYS2920, ELEC0802*


**MINE1630**
Excavation Engineering (Blasting)  
*Staff Contact: A/Prof G.C. Sen*  
S1 L2  
Percussive, rotary and hydraulic rock drilling equipment: applications and operating principles, maintenance. Drilling

MINE1631
Excavation Engineering (Machine Mining)
Staff Contact: Prof F.F Roxborough
S2 L1

MINE1740
Mining Legislation
Staff Contact: Dr C.R. Daly
S2 L2
An appreciation of the laws relating to coal and metal mining practice and to safety and health in mines.

MINE1830
Mine Ventilation and Environment
Staff Contact: Dr V.S. Vutukuri
S2 L2 T2
Prerequisites: MINE0210, MINE1420, MINE1320
Mine ventilation: practice in mines, forces causing airflow, resistance of workings and distribution of mine air, network analysis, fans and their operation, auxiliary ventilation, economic size of airways; ventilation surveys. Mine environment: mine gases; hazards, occurrence, detection, monitoring and control, airborne dust; physiological effects, sampling, measurement and analysis, sources and control. Ventilation planning: airflow requirements based on pollutant gas, airborne dust and heat. Laboratory experiments.

MINE1930
Industrial Training
Staff Contact: Dr A.C. Partridge
S0 L0 T0
Students are required to gain practical experience totalling no less than 100 days during successive long recesses and are required to submit for assessment a suitably presented report on their experience gained during the recess prior to their final year of study. Reports are to include a review of the operations of the company providing the experience and full details of the work carried out by the student. After appraisal by a staff member and any required amendments, a copy is provided for the mine manager or other responsible person at the place of employment.

MINE1940
Tunnel Engineering and Shaft Sinking
Staff Contact: A/Prof G.C. Sen
S1 L2

MINE2141
Mineral Economics
Staff Contact: Mr D. Panich
S1 L2
Prerequisites: MINE1131, MINE1132

MINE2142
Mine Planning and Design
Staff Contact: Mr D. Panich
F L1 T2
Prerequisites: MINE1131, MINE1132
Corequisite: MINE2141

MINE2240
Mining Management
Staff Contact: Dr C.R. Daly
S2 L2 T1

MINE3040
Mine Safety Engineering
Staff Contact: Dr V.S. Vutukuri
S2 L1.5 T1.5
Prerequisites: MINE 0210, MINE1420
for mine lighting, photometry, design of lighting systems. Laboratory experiments.

MINE3041
Hazard and Risk in Mining
Staff Contact: Prof J. Cross
S1 L2

MINE3140
Computational Methods in Geomechanics
Staff Contact: Dr J.O Watson
S1 L2
Prerequisites: MINE1231, MINE1232
Boundary value problems: review of strategies for solution, and limitations of analytical methods; finite differences. Finite elements: variational principle and finite elements for Poisson's equations; global and elemental stiffness matrices and equivalent nodal force vectors; matrix assembly and equation solution; variational principle and finite elements for elasticity; constant strain triangular element, isoparametric elements; design of meshes, error estimates; adaptive mesh refinement; computer program for elastic analysis of plain strain; elastoplasticity, elastoviscoplasticity. Boundary elements: fundamental solution and integral equations for Poisson's equation; isoparametric boundary elements; construction and solution of discrete systems of equations; direct boundary element method for elasticity; design of meshes; computer programs for elastic analysis of strain.

MINE3240
Operations Research
Staff Contact: Dr C.R. Daly
S1 L1 T1
Linear programming, decision analysis, queuing theory, simulation, forecasting, reliability, replacement, inventory and production, dynamic programming. Project management, use of project management software.

MINE4140
Minerals Industry Project
Staff Contact: Dr A.C. Partridge
F T4
Candidates are required to submit a dissertation or thesis on a mining, minerals engineering or other topic approved by the Head of Department. The work may take the form of an engineering analysis, experimental investigation, theoretical study or design project. Candidates may be required to present themselves for oral examination on the subject of their submission.

MINE4240
Industrial and Research Seminars
Staff Contact: Mr D. Panich
F L1
A series of seminars presented by invited speakers from within the university, other research establishments and selected industrial operations, covering special topics of current interest.

MINE4540
The Mining Engineering Profession in Society
Staff Contact: Dr J.O. Watson
S2 L1 T1
Prerequisite: APSE0002
The numerous sections of society with which mining engineers may interact and their diverse expectations; the potential for divided loyalty, mistrust and conflict. The consequences of mining engineers being employed as professionals; codes of ethics and their effectiveness; scepticism about the attitude of 'limited responsibility'. Possible future controls of the profession and industry. One of the following: (a) The potential impact of an international policy of sustainable development on the mineral industry and how it may be implemented; or (b) a systematic process of decision making, illustrated by assessment procedures for major projects and raising the issue of who would be involved; or (c) how responsible people outside the mineral industry see key problems associated with the industry in Australia. The subject will be taught via tutorials and a mini-project.

MINE7342
Minerals Engineering Processes
Staff Contact: Dr A.C. Partridge
F L1 T1

MINE7440
Mineral Process Technology
Staff Contact: Dr A.C. Partridge
S1 L1.5 T.5
Graduate Study

Course Outlines

Department of Applied Geology

Master of Applied Science courses are designed to give advanced training in developing specialisations within geology and are structured specifically for candidates from industry to take on a part-time basis.

Courses currently offered are in the fields of Engineering Geology, Hydrogeology, Environmental Geology, and Geological Data Processing.

8020 Engineering Geology/Hydrogeology/Environmental Geology Course

Master of Applied Science MAppSc

The course consists of a Project (Group A) and from five to eight subjects chosen from Group B, of which five are core subjects of the course. The total credit point requirement of the course is 30, of which the project could account for 6, 9 or 15 credit points. The 6 and 9 credit point project is aimed at those students who prefer a higher content of teaching in their MAppSc course, or who find that their interests are not fully covered within the core subjects.

The five core subjects are all taught in the first session. Up to three additional subjects, completed by full-time attendance during the second session, or part-time, or as an external student, may be credited towards the degree, with a consequent reduction in the project requirements. The project normally consists of field and laboratory work, and is related to the students major interests. Students must consult the Course Director for approval of the project topic. Students undertaking fieldwork may incur personal costs.

Group B
Core Subjects (3 credit points)
CIVL9788 Site Investigation
GEOL9011 Hydrogeology G
GEOL9030 Geological Engineering
GEOL9040 Fundamentals of Geomechanics
GEOL9060 Environmental Geology

Elective Subjects (3 credit points)
CIVL9790 Stability of Slopes
GEOL0110 Geological Remote Sensing
GEOL9031 Engineering Geology of Surficial Deposits
GEOL9032 Soil and Rock Construction Materials
GEOL9033 Terrain Evaluation
GEOL9070 Engineering Geophysics

An additional requirement for the award of the MAppSc Engineering Geology is the satisfactory completion of laboratory and field practical sessions, attendance on field excursions, and contributions to tutorials and seminars.

8094 Geological Data Processing

Master of Applied Science MAppSci

This program is intended for industry-based geologists who wish to enhance their skills in the computer processing of geological data. It is delivered as a series of separate academic subjects, each consisting of a one week residential short course with additional assignment material and an industry-based project. The short courses are scheduled to allow the degree program to be completed on a part-time basis over two years. The program allows an emphasis to be placed on data processing in mineral exploration, exploration geochemistry, ore reserve estimation, image processing and remote sensing, exploration geophysics or fossil fuel deposits. Optional subjects are also available to provide complimentary training in topics such as mine and environmental management and project evaluation.

Candidates are required to complete a course of 30 credits including either a 6 or 12 credit project. Alternative subjects may be substituted in the published program at the discretion of the Head of the Department.
Core Subjects
These subjects are compulsory:
GEOL0300 Computing and Statistics for Geologists*
GEOL0310 Image Processing of Spatial Data Sets
GEOL0320 Geostatistical Ore Reserve Estimation
Totalling 9 credit points
and either
GEOL0304 Data Processing Project 1 6 credit points or
GEOL0314 Data Processing Project 2 12 credit points

Electives
Between 9 and 15 credits of elective subjects may be selected to make a total of 30 credits.

Technical (3 credit points)
GEOL0330 Conceptual Models for Exploration Geology
GEOL0340 Geochemical Exploration Techniques
GEOL0350 Exploration Geochemical Data Processing
GEOL0360 Remote Sensing Applications in Geoscience
GEOL0370 Fundamentals of Exploration Geophysics
GEOL0380 Electrical Methods in Geophysical Exploration
GEOL0390 Data Processing for Fossil Fuel Resources
KCME1106 Soil and Rock Construction Materials
KCME1108 Applied Structural Geology
KCME1109 Geophysics for Mine Development
KCME1110 Geographical Information Systems in Applied Geology
KCME4133 An Introduction to Environmental Geology
KCME4302 Environmental Assessment

Business Management (3 credit points)
KCME4201 Export Marketing for the Mining Industry
KCME4202 Mine Evaluation and Project Assessment
KCME4203 Mine Management
KCME4204 Exploration Project Management
KCME4301 Environmental Management for the Mining Industry
or such other subjects as the course authority may deem to be appropriate and equivalent.
* For students with an adequate background in computing and statistics this subject may be replaced by an additional elective subject. The approval of the course authority is required.

1000
Doctor of Philosophy (PhD) and

2000
Master of Science (MSc)

Research may be undertaken in fundamental or applied aspects of Geology. Collaborative programs with industry and government are encouraged. The following lists should not be considered as limiting the possible scope of any research project.

Mineral and Energy Resources
Exploration Geochemistry
Exploration Geophysics
Mineral Exploration
Ore Forming Processes
Resource Economics
Remote Sensing in Exploration
Image Processing
Petroleum and Coal Geology

Non metallic Mineral Resources
Marine Geophysics
Mathematical Geology
Sedimentary Basin Analysis
Geological Data Processing

Engineering and Environmental Studies
Environmental Geology
Engineering Geology
Geomechanics
Clays and Aggregates
Coastal and Estuarine Geology

Hydrogeology and Waste Management
Hydrogeology
Contaminant Hydrogeology
Groundwater Geophysics
Groundwater Studies and Modelling
Waste and Landfill Disposal
Groundwater Contaminant Transport

Fundamental Geological Studies
Palaeontology
Micro palaeontology
Petrology
Stratigraphy
Sedimentology
Structural Geology
Antarctic Geology
Marine Science

UNSW Groundwater Centre

The Groundwater Centre was established in 1987 as a Federal National Centre (Centre for Groundwater Management and Hydrogeology). In 1992, the Centre was reorganised as a joint initiative of the Faculties of Engineering and Applied Science with the general objectives of improving and continuing teaching and research in groundwater studies.

The Centre offers specialised graduate courses in Groundwater Studies and carries out general teaching in Hydrogeology to Applied Science and Engineering postgraduate students.

8021
Hydrogeology and Groundwater Management Graduate Course

Master of Applied Science MAppSc

For the Master of Applied Science in Groundwater Management and Hydrogeology candidates are required to complete 30 credits, made up of the five core subjects, elective subjects and a project. The degree may be taken internally on a full-time (normally 2 sessions) or a part-time (normally 4 sessions) basis. The course of study must be approved by the Head of School or the Head’s nominee.
### Core Subjects (3 credit points)
- GEOL9010  Groundwater Environments
- GEOL9051  Hydrogeochemistry
- CIVL9880  Groundwater Modelling
- CIVL9861  Environmental and Engineering Geophysics
- CIVL9875  Hydrological Processes

### Elective Subjects (3 credit points)
- GEOL9012  Contaminant Hydrogeology (short course format)
- GEOL9052  Advanced Hydrogeochemistry (short course format)
- GEOL9100  Remote Sensing of Groundwater Resources
- CIVL9799  Environmental Geomechanics
- KCME1110  Geographic Information Systems in Applied Geology

### Project
- GEOL9124  Groundwater Project 9 credit points
- GEOL9144  Groundwater Research Project 12 credit points

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### Waste Management Graduate Courses
- 8612 (Internal)
- 8614 (External)

### Master of Engineering Science
- **MEngSc**

The Master of Engineering Science degree is undertaken through the School of Civil Engineering in the Faculty of Engineering. Full details are available in the Faculty of Engineering handbook.

- 5495 (Internal)
- 5498 (External)

### Graduate Diploma
- **Grad Dip**

The Graduate Diploma is undertaken through the School of Civil Engineering in the Faculty of Engineering.

### Alternative Graduate Programs

Alternative Graduate Programs in association with the Department of Applied Geology are available in the following areas:

### School of Geography
- 5026 Graduate Diploma in Remote Sensing (GradDip)
- 8026 Remote Sensing Graduate Course (MAppSc)
- 8045 Environmental Studies Graduate Course (MEnvStudies)

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### Faculty of Engineering

- 5495 Graduate Diploma in Remote Sensing (GradDip)
- 8640 Remote Sensing Graduate Course (MEngSc)

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### Department of Mining Engineering

#### 8055

**Mining and Mineral Engineering Graduate Course**

### Master of Applied Science
- **MAppSc**

This course is offered to provide postgraduate training in subjects appropriate to the mining industry. There is a core of professional subjects, and the electives needed to complete the course be taken to suit a graduate's previous experience or a chosen career path.

The MAppSc course is linked with the Mining Management Graduate and Graduate Diploma Courses offered through the Key Centre for Mines, and transfer between these programs will be possible with appropriate credit for subjects completed.

The Master of Applied Science program has been designed for completion of its 36 credit points in one year full time. The teaching components should be completed in two sessions. The subjects which are listed below may be offered in two formats dependent on class sizes and student skills, and in general should be completed within one session.

A full teaching session subject will comprise approximately fourteen weeks of lectures, tutorials, and any associated laboratory work. Alternatively, the lecture material may be offered as a one week short course module in conjunction with the Key Centre equivalent course. The module would be preceded and followed by appropriate reading and tutorials. Assessment will consist of a combination of assignments and examinations complement the lecture mode.

Due to the varied entry routes there will be a difference of skills among candidates. Consequently there are two prescribed core courses, one for non-mining entrants, and the other for qualified mining graduates and entrants from the Graduate Diploma course. Exemptions may be given from one or more core subjects to appropriate candidates but a full complement of 36 credit points must still be attained.
Entry for Four Year Graduates - Non-Mining

Core Subjects

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINE0130</td>
<td>Principles of Mining</td>
<td>2</td>
</tr>
<tr>
<td>MINE1224</td>
<td>Mining Engineering Technology</td>
<td>6</td>
</tr>
<tr>
<td>MINE1524</td>
<td>Mining Conservation</td>
<td>3</td>
</tr>
<tr>
<td>MINE3114</td>
<td>Mineral Beneficiation</td>
<td>3</td>
</tr>
<tr>
<td>and one of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MINE5064</td>
<td>Minor Project</td>
<td>6</td>
</tr>
<tr>
<td>MINE5124</td>
<td>Project</td>
<td>12</td>
</tr>
<tr>
<td>MINE5184</td>
<td>Major Project</td>
<td>18</td>
</tr>
</tbody>
</table>

Entry for Graduates in Mining Engineering or from Course 5040

Core Subjects

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINE5324</td>
<td>Principles of Mining Engineering</td>
<td>6</td>
</tr>
<tr>
<td>MINE1524</td>
<td>Mining Conservation</td>
<td>3</td>
</tr>
<tr>
<td>and either</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MINE3224</td>
<td>Mineral Beneficiation Technology</td>
<td>6</td>
</tr>
<tr>
<td>MINE4424</td>
<td>Mineral Industry Analysis</td>
<td></td>
</tr>
<tr>
<td>and one of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MINE5064</td>
<td>Minor Project</td>
<td>6</td>
</tr>
<tr>
<td>MINE5124</td>
<td>Project</td>
<td>12</td>
</tr>
<tr>
<td>MINE5184</td>
<td>Major Project</td>
<td>18</td>
</tr>
<tr>
<td>MINE3654</td>
<td>Minerals Engineering Project</td>
<td>9</td>
</tr>
</tbody>
</table>

Notes:
(1) or equivalent subject from Key Centre for Mines
(2) Minerals Engineering candidates may be permitted to substitute electives if they have a mining industry background.
(3) The choice of project is subject to approval from the Head of School.

Elective subjects for all candidates

(2 credit points)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINE5655</td>
<td>Rock Slope Stability</td>
</tr>
<tr>
<td>MINE5755</td>
<td>Subsidence Engineering</td>
</tr>
<tr>
<td>MINE9174</td>
<td>Fire and Explosion</td>
</tr>
</tbody>
</table>

(3 credit points)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOL0300</td>
<td>Computing and Statistics for Geologists</td>
</tr>
<tr>
<td>GEOL0330</td>
<td>Geostatistical Ore Reserve Estimations</td>
</tr>
<tr>
<td>GEOL0390</td>
<td>Conceptual Models for Exploration Geology</td>
</tr>
<tr>
<td>MINE0014</td>
<td>Exploration Drilling</td>
</tr>
<tr>
<td>MINE1514</td>
<td>Ground Control and Excavation Engineering</td>
</tr>
<tr>
<td>MINE1534</td>
<td>Environmental Conditions in Mines</td>
</tr>
<tr>
<td>MINE1544</td>
<td>Rock Excavation and Transportation</td>
</tr>
<tr>
<td>MINE3514</td>
<td>Mineral Beneficiation Plant Design</td>
</tr>
<tr>
<td>MINE3634</td>
<td>Minerals Engineering Laboratory</td>
</tr>
<tr>
<td>MINE4424</td>
<td>Minerals Industry Analysis</td>
</tr>
<tr>
<td>MINE4055</td>
<td>Numerical Methods in Geomechanics</td>
</tr>
<tr>
<td>MINE4155</td>
<td>Stability of Slopes</td>
</tr>
<tr>
<td>MINE5155</td>
<td>Rock Mechanics Measurements</td>
</tr>
<tr>
<td>MINE5255</td>
<td>Strata Control Engineering</td>
</tr>
<tr>
<td>MINE5355</td>
<td>Mine Fill Technology</td>
</tr>
<tr>
<td>MINE5455</td>
<td>Advanced Rock Cutting Technology</td>
</tr>
<tr>
<td>MINE5555</td>
<td>Blasting Technology</td>
</tr>
<tr>
<td>MINE9364</td>
<td>Equilibrium Concepts in Water Systems</td>
</tr>
<tr>
<td>MINE9374</td>
<td>Hydrogeochemistry</td>
</tr>
<tr>
<td>MINE9415</td>
<td>Advanced Rock Mechanics</td>
</tr>
</tbody>
</table>

(6 credit points)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINE3224</td>
<td>Mineral Beneficiation Technology</td>
</tr>
<tr>
<td>MINE3614</td>
<td>Minerals Engineering 1</td>
</tr>
<tr>
<td>MINE3624</td>
<td>Minerals Engineering 2</td>
</tr>
<tr>
<td>MINE3644</td>
<td>Minerals Engineering 3</td>
</tr>
</tbody>
</table>

Notes:
(1) Any Key Centre module may also be taken, subject to (2).
(2) Electives must be chosen on enrolment and approved by the Course Director; some electives are mutually exclusive.
(3) Attention is also drawn to subjects available from the for Department of Safety Science, the Centre for Waste Management and the School of Chemical Engineering. Subjects to timetables and minimum class sizes in various departments, electives may be chosen from those and other course authorities.
(4) Not all electives in the above list will be offered each year.

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5040
Mining and Mineral Engineering Graduate Diploma Course

Graduate Diploma
GradDip

The Graduate Diploma course in Mining and Mineral Engineering serves two purposes. It can provide a professional introduction to the mining industry for graduates in Science, Applied Science or Engineering and it is a qualifying course for entry to the Master of Applied Science and Master by Research programs.

The Graduate Diploma will be awarded after successful completion of one year full-time or two years part-time study. The course is a blend of lecture and laboratory work and an appropriate choice of the laboratory work and project can lead to some specialisation in either mining engineering or minerals engineering. When appropriate, some sections of the course may be offered as a unit over a short period to permit mineral industry personnel to attend on a part-time basis.

The level of the Graduate Diploma is designed to be equivalent to a four-year honours degree and on that basis up to 9 credit points of undergraduate subjects may be substituted for the topics shown where appropriate to the skills of the student concerned.

Full-time Program

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINE0130</td>
<td>Principles of Mining</td>
<td>2</td>
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<tr>
<td>MINE1114</td>
<td>Mining Engineering</td>
<td>6</td>
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<tr>
<td>MINE1224</td>
<td>Mining Engineering Technology</td>
<td>6</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MINE3324</td>
<td>Mineral Beneficiation Technology</td>
<td>6</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MINE1324</td>
<td>Mining Laboratory and Project</td>
<td>8</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MINE3324</td>
<td>Mineral Engineering Laboratory and Project</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Points</th>
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</thead>
<tbody>
<tr>
<td>MINE2340</td>
<td>Mineral Economics</td>
<td></td>
</tr>
<tr>
<td>MINE3114</td>
<td>Mineral Beneficiation</td>
<td></td>
</tr>
<tr>
<td>MINE7140</td>
<td>Mineralogical Assessment</td>
<td>1</td>
</tr>
<tr>
<td>MINE7341</td>
<td>Mineral Process Engineering</td>
<td>2</td>
</tr>
</tbody>
</table>

Totalling 30
Part-time Program

This should be discussed with the Head of Department. In principle, the part-time program should be completed in two years by taking approximately 15 credit points in each year. MINE1224 and MINE1324, or MINE3224 and MINE3324 would be taken in the second year.

Electives

Subjects with a value of up to 6 credit points taken from within the School of Mines may be substituted for those listed above, subject to approval by the Course Director. Subjects from other courses in the University may also be chosen by agreement with the appropriate Head of School.

Key Centre for Mines

The Key Centre is a joint initiative of the Universities of New South Wales and Wollongong. Funded by the Department of Employment, Education and Training. The purpose of the Key Centre for Mines is to provide a full range of educational and research services to the minerals industries.

Particular emphasis is being placed on continuing education, distance learning and industry-based research and development.

The industry sector being addressed by the Key Centre for Mines covers the exploration, extraction, and primary processing of mineral resources.

8057
Master of Mining Management

MMinMgmt

5057
Graduate Diploma in Mining Management

GradDipMinMgmt

The courses are designed to give mining personnel the opportunity to extend their career paths into management levels. Candidates will be able to select course work modules from Business Management and Science and Technology Streams. The delivery of the course work modules has been designed to enable the participation of professional staff in the minerals industries no matter how remote the location of their particular operation. This delivery will either be in the form of one week short courses, with follow-up assignments, or by correspondence only. Each module is of 3 credits value. In normal circumstances no more than two modules may be undertaken by correspondence.

It is anticipated that candidates will come from a wide range of educational and training backgrounds. The normal entry qualification for the Graduate Diploma is a relevant three-year degree or equivalent. This may be demonstrated by equivalent experience and/or the holding of a position of appropriate responsibility. The normal entry qualification for the Masters degree is a relevant four-year degree or equivalent. This may be demonstrated by equivalent experience and/or the holding of a position of appropriate responsibility. A preliminary program is available for candidates who do not fully meet the normal requirements.

A 9 credit point industry-based project and five modules are required for the GradDipMinMgmt with a minimum of two from either the Business Management or the Science and Technology Streams. For the Master of Mining Management it is necessary to complete eight modules, with a minimum of three from either stream. The Master’s program also includes an industry-based project equivalent to one third of the course. The courses will be structured in a way that allows movement between the two programs in some circumstances; a graduate of the GradDipMinMgmt course may be able to continue to a MMinMgmt by completing a further three modules and the larger industry-based project.

Assessment is by assignment for most modules but may be by formal examination. Examination of the correspondence components of the course is undertaken at a number of regional centres.

Science and Technology Modules (3 credit points)
KCME1102 Mine Safety Management*
KCME1103 Drilling and Blasting
KCME1105 Slope Stability for Surface Mining
KCME1106 Soil and Rock Construction Materials
KCME1107 Introductory Computing for Geologists and Mining Engineers
KCME1108 Applied Structural Geology
KCME1302 Mine Ventilation and Environment
KCME2101 Strata Control
KCME2104 Application of Computers in the Mining Industry
KCME2105 Geostatistics and Ore Body Modelling
KCME2107 Mine Water Origin, Inflow, Prediction and Control**
KCME3101 Coal Preparation
KCME4102 Placer Technology
KCME4133 An Introduction to Environmental Geology
KCME4301 Environmental Management for the Mining Industry
KCME4302 Environmental Assessments

Business Management Modules (3 credit points)
KCME1102 Mine Safety Management*
KCME3201 Financial Management**
KCME3202 Management Perspectives**
KCME3203 Economic Decision Making**
KCME3204 Management of Innovation**
KCME3205 Strategic Planning**
KCME3206 Mining Law
KCME4201 Export Marketing for the Minerals Industry
KCME4202 Mine Evaluation and Project Assessment
KCME4203 Mine Management
KCME4204 Mineral Exploration Project Management
KCME4301 Environmental Management for the Mining Industry*

*May be taken as either a Science and Technology or a Business Management module
**May be offered by correspondence
Industry-Based Projects
KCME1300 Mining Management Project
12 credit points (8057 only)

KCME1400 Mining Management Project
9 credit point (5057 only)

Unless otherwise stated all modules are of 3 credit value.
Equivalent or additional courses can be added at the discretion of the Head of the School of Mines.
Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organisational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

Department of Applied Geology

GEOL9010 Groundwater Environments
Staff Contact: Dr J. Jankowski/Dr R.I. Acworth
C3 S1
Physical properties of groundwater. Darcy flow; hydraulic conductivity - field and laboratory methods; storage and transmissivity; flow nets - local and regional flow systems. Drilling methods; well design and completion; well development; pumping tests and interpretation. Study of the detailed occurrence; methods of development and environmental problems associated with groundwater, in aquifer systems of importance to Australia. Environments will include fractured rock systems (upland salinity); the Murray-Darling Basin; The Great Artesian Basin; Oceanic islands and coastal aquifers and karstic aquifer systems.

GEOL9011 Hydrogeology
Staff Contact: Dr J. Jankowski/Dr R.I. Acworth
C3 S1 L1.5 T1.5
Physical properties of groundwater. Darcy flow; hydraulic conductivity - field and laboratory tests. Storage and transmissivity; flow nets; local and regional flow systems. Drilling methods; well design and completion; well development; pumping tests and interpretation. Groundwater chemistry. Introduction to contamination. Geophysical methods for groundwater investigation. Groundwater modelling - finite difference methods. Introduction to remote sensing for groundwater.

GEOL9012 Contaminant Hydrogeology
Staff Contact: Dr J. Jankowski/Dr R.I. Acworth
C3 S2
Sources of groundwater contamination; groundwater quality investigation; groundwater sampling procedures at contaminated sites; water quality criteria and review of Australian legislation. Hydrochemical modelling for inorganic and organic contaminant plumes; analytical and numerical approaches to modelling contaminant transport, dispersion, diffusion, adsorption and desorption processes. Groundwater restoration; site remediation. Occupational health and safety issues. Case studies in contaminant hydrogeology; practical field techniques; drilling, probing, piezometer installation, pumping equipment and sampling procedures, slug and tracer tests.

GEOL9030 Geological Engineering
Staff Contact: Mr G. McNally
C3 S1 L1.5 T1.5

GEOL9031 Engineering Geology of Surficial Materials
Staff Contact: Mr G. McNally
C3 S2
Geotechnical characteristics of alluvial, colluvial, eolian, coastal and residual soils; duricrusts and deep water weathering; problem soils (expansive, dispersive, collapsing, compressible and saline); stabilisation and improvement of inferior materials; influence of Cainozoic climatic changes and geological history of regolith in Australia and adjacent areas.

GEOL9032 Soil and Rock Construction Materials
Staff Contact: Mr G. McNally
C3 S2
Location and assessment of sand, gravel, hard rock, brick clay, building stone and limestone; specification and testing of aggregate, ballast and roadbase; concrete and asphaltic materials; blasting, crushing and beneficiation; environmental considerations, blast monitoring and quarry reclamation; waste and synthetic materials.

GEOL9033 Terrain Evaluation
Staff Contact: Mr G. McNally
C3 S2
Introduction to photogeology and image interpretation, with emphasis on geotechnical applications; interpretation of geological structure, lithology and surficial deposits; terrain evaluation for engineering purposes, with Australian examples. Course content includes lectures, supervised practical work and individual assignments. Intended to complement GEOL0110 (Geological Remote Sensing), emphasising airphotos as a data source.

GEOL9040 Fundamentals of Geomechanics
Staff Contact: Prof G. Hocking
C3 S1 L1.5 T1.5
Engineering mechanics, limit equilibrium, equilibrium of multiple bodies, stress and strain in two and three dimensions, equations of equilibrium and compatibility. Isotropic and anisotropic elasticity, plastic and viscous yield criteria and potential surfaces. Stereographic projection methods for rock mechanics. Geomechanical properties and classification of soils and rocks. Laboratory and field
testing techniques for soils and rocks. Deformability and strength properties of rocks and shear strength of rock discontinuities. Stresses about rock openings and beneath point loads. Stress measurement in rocks.

**GEOL9051**
**Hydrogeochemistry**
*Staff Contact: Dr J. Jankowski/Dr R.I. Acworth*
*C3 S1*
Chemical composition of natural and contaminated groundwaters; inorganic parameters in natural waters; methods of expressing concentration and representation of hydrochemical data; interpretation of chemical analyses, chemical types of waters; aqueous geochemistry, chemical thermodynamics, activities of ionic species, equilibrium reactions, non-equilibrium approaches, the carbonate system and pH control; chemical weathering, water-rock interactions; clay minerals and ion exchange, silicate equilibria, mass balance, oxidation and reduction, redox equilibria, redox processes and reactions. Application of physical chemistry to groundwater systems. Geochemical evolution of groundwater. Introduction to hydrochemical modelling. Introduction to isotope studies; case studies in natural and polluted environments.

**GEOL9052**
**Advanced Hydrogeochemistry**
*Staff Contact: Dr J. Jankowski/Dr R.I. Acworth*
*C3 S2*
Environmental isotopes; radioactive decay; stable and radioactive isotopes and their application to groundwater studies; bacteriology: basic principles of bacteriology and microbiology of polluted environments; biochemistry, advanced thermodynamics and kinetics; mass transport and mass balance studies in groundwater systems; computer methods in geochemical modelling including forward and inverse methods and geochemical modelling codes; case studies and application of computer codes in groundwater modelling; practical field measurement and use of field hydrochemical equipment; laboratory analysis and the use of the chemical laboratory equipment.

**GEOL9060**
**Environmental Geology**
*Staff Contact: Mr G. McNally*
*C3 S1 1L1.5 T1.5*

**GEOL9070**
**Engineering Geophysics**
*Staff Contact: Mr D. Palmer*
*C3 S1 2L T1*
Note/s: Short field tutorials are included as part of this subject. Students will incur personal costs.

Shallow seismic refraction: elastic theory, sources and equipment. Determination of fracture index, rippability. Applications to damsites, highways, depth of weathering, material quality. Seismic reflection. Sparker and boomer profiling, side scan sonar with application to coastal harbours, sewer outfalls. Electrical methods, direct current geo-electric theory, resistivity sounding and profiling with applications to determination to bedrock depth, location of water table, clay-filled dykes, shear zones. Magnetic, electromagnetic and gravity methods as applied to engineering problems. Geophysical well logging: resistivity, self potential, gamma ray and sonic logs applied to determination of rock properties and location of clay-filled joints.

**GEOL9100**
**Remote Sensing of Groundwater Resources**
*Staff Contact: Applied Geology Office*
*C3 S1 1L1.5 T1.5*
The physics of various remote sensing techniques; interpretation of conventional aerial photography in exploration; Infrared remote sensing techniques; side looking airborne radar; theory and applications of Landsat imagery; enhancement techniques for satellite imagery; interpretation of Landsat photographic products and application to several case history areas. Integration of remote sensing information with the overall database as applied to exploration. Remote sensing for hydrogeological mapping, recognition of aquifers and recharge, discharge zones, salinity mapping. Application of Landsat, TM, SPOT, RADAR and integrated information systems.

**GEOL9124**
**Groundwater Project**
*Staff Contact: Dr R.I Acworth*
*C9 S2*
Study of similar content to GEOL9144 but at a smaller scale.

**GEOL9144**
**Groundwater Research Project**
*Staff Contact: Dr R.I Acworth*
*C12 S2*
Note/s: Students undertaking field work may incur personal costs.

Research investigation consisting of one or more of; modelling, laboratory experiments, field work related to groundwater studies.

**GEOL9444**
**Project In Engineering Geology**
*Staff Contact: Mr G. McNally*
*C6*
Study of similar content to GEOL9464 but at a much smaller scale.

**GEOL9454**
**Project In Engineering Geology**
*Staff Contact: Mr G. McNally*
*C9*
Study of similar content to GEOL9464 but at a smaller scale.
The physics of various remote sensing techniques; interpretation of conventional aerial photography in exploration; Infrared remote sensing techniques; side looking airborne radar; theory and applications of Landsat imagery; enhancement techniques for satellite imagery; interpretation of Landsat photographic products and application to several case history areas. Integration of remote sensing information with the overall data base as applied to exploration.

**GEOL0114**
Project in Geological Remote Sensing
*Staff Contact: Key Centre for Mines*

Note/s: Restricted to program 8026

**GEOL0110**
Geological Remote Sensing
*Staff Contact: A/Prof G. R. Taylor*

C3 SS L2 T1

The physics of various remote sensing techniques; interpretation of conventional aerial photography in exploration; Infrared remote sensing techniques; side looking airborne radar; theory and applications of Landsat imagery; enhancement techniques for satellite imagery; interpretation of Landsat photographic products and application to several case history areas. Integration of remote sensing information with the overall data base as applied to exploration.

**GEOL0340**
Geochemical Exploration Techniques
*Staff Contact: Key Centre for Mines*

C3 SS L2 T1


**GEOL0350**
Exploration Geochemical Data Processing
*Staff Contact: Dr D. R. Cohen/Dr A. C. Dunlop*

C3 SS L2 T1


**GEOL0114**
Project in Geological Remote Sensing
*Staff Contact: Key Centre for Mines*

Note/s: Restricted to program 8026

**GEOL0110**
Geological Remote Sensing
*Staff Contact: A/Prof G. R. Taylor*

C3 SS L2 T1

The physics of various remote sensing techniques; interpretation of conventional aerial photography in exploration; Infrared remote sensing techniques; side looking airborne radar; theory and applications of Landsat imagery; enhancement techniques for satellite imagery; interpretation of Landsat photographic products and application to several case history areas. Integration of remote sensing information with the overall data base as applied to exploration.

**GEOL0340**
Geochemical Exploration Techniques
*Staff Contact: Key Centre for Mines*

C3 SS L2 T1


**GEOL0350**
Exploration Geochemical Data Processing
*Staff Contact: Dr D. R. Cohen/Dr A. C. Dunlop*

C3 SS L2 T1


**GEOL0014**
Project in Geological Remote Sensing
*Staff Contact: Key Centre for Mines*

Note/s: Restricted to program 8026

**GEOL0110**
Geological Remote Sensing
*Staff Contact: A/Prof G. R. Taylor*

C3 SS L2 T1

The physics of various remote sensing techniques; interpretation of conventional aerial photography in exploration; Infrared remote sensing techniques; side looking airborne radar; theory and applications of Landsat imagery; enhancement techniques for satellite imagery; interpretation of Landsat photographic products and application to several case history areas. Integration of remote sensing information with the overall data base as applied to exploration.

**GEOL0340**
Geochemical Exploration Techniques
*Staff Contact: Key Centre for Mines*

C3 SS L2 T1


**GEOL0350**
Exploration Geochemical Data Processing
*Staff Contact: Dr D. R. Cohen/Dr A. C. Dunlop*

C3 SS L2 T1


**GEOL0014**
Project in Geological Remote Sensing
*Staff Contact: Key Centre for Mines*

Note/s: Restricted to program 8026

**GEOL0110**
Geological Remote Sensing
*Staff Contact: A/Prof G. R. Taylor*

C3 SS L2 T1

The physics of various remote sensing techniques; interpretation of conventional aerial photography in exploration; Infrared remote sensing techniques; side looking airborne radar; theory and applications of Landsat imagery; enhancement techniques for satellite imagery; interpretation of Landsat photographic products and application to several case history areas. Integration of remote sensing information with the overall data base as applied to exploration.

**GEOL0340**
Geochemical Exploration Techniques
*Staff Contact: Key Centre for Mines*

C3 SS L2 T1


**GEOL0350**
Exploration Geochemical Data Processing
*Staff Contact: Dr D. R. Cohen/Dr A. C. Dunlop*

C3 SS L2 T1

The relationships between geology and electrical geophysical properties; basic theory of resistivity, induced polarisation and electromagnetic methods. Evaluation of applications, survey design, instrumentation, data acquisition, interpretation and productivity. Computer methods of interpretation are emphasised by the extensive use of hands-on microcomputer tutorials. An introduction to recent advances in electrical geophysics: inversion, multi-electrode array resistivity, spectral induced polarisation, transient electromagnetics and ground probing radar.

**GEOL0390**  
Data Processing for Fossil Fuel Resources  
*Staff Contact: Key Centre for Mines*  
C3 SS L2 T1

Sedimentary basin analysis with special emphasis on the geology of coal deposits; coal deposit evaluation, data acquisition, computer processing, analysis and display.

**GEOL0304**  
Data Processing Project 1  
*Staff Contact: A/Prof G.R. Taylor*  
C6 SS

A minor project equivalent to 6HPW study for one session which will require the student to carry out detailed processing and analysis of a comprehensive data set for an exploration project that may relate to the student's field of employment.

**GEOL0314**  
Data Processing Project 2  
*Staff Contact: A/Prof G.R. Taylor*  
C12 SS

A research project equivalent to 12 hpw study for one session which requires the student to carry out detailed processing, analysis and integration of a multi-attribute data set for an exploration project that may relate to the student's field of employment.

**GEOL0004**  
Special Program Applied Geology  
*Staff Contact: Dr A.C. Dunlop / Mr G. McNally*  
Note/s: For programs 8020, 8021 and 8094

**GEOL0005**  
Research Thesis Applied Geology Full-time  
*Staff Contact: Dr A.C. Dunlop*  
Note/s: For programs 1000 and 2000

**GEOL0006**  
Research Thesis Applied Geology Part-time  
*Staff Contact: Dr A.C. Dunlop*  
Note/s: For programs 1000 and 2000

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**Department of Mining Engineering**

Generally these subjects are of three hours' duration per week or multiples of that time.

**MINE0014**  
Exploration Drilling  
*Staff Contact: School Office*  
C3 S1 or S2 HPW3


**MINE1114**  
Mining Engineering  
*Staff Contact: Dr V.S. Vutukuri*  
C6 F HPW3


**MINE1224**  
Mining Engineering Technology  
*Staff Contact: Dr V.S. Vutukuri*  
C6 F HPW3


**MINE1324**  
Mining Engineering Laboratory  
*Staff Contact: Dr V.S. Vutukuri*  
C8 F HPW4

A selection of advanced laboratory investigations in sampling and valuation, mine support, temporary or long term; mine design and plant related to extraction and servicing functions; rock properties; programming of mining methods and transport; non-entry mining; petroleum engineering; gasification; solvent processes.
MINE1514
Ground Control and Excavation Engineering
Staff Contact: Dr. V.S. Vutukuri
C3 FHPW3

MINE1524
Mining Conservation
Staff Contact: Dr. V.S. Vutukuri
C3 S1 or S2 L2 T2
The reclamation of excavated land; integration with operational stages of mining. Mining cycles of alluvial, strip, and open cuts, land clearing, stabilizing the mined area, socioeconomic aspects of mining, rehabilitation costs, government regulations. Examination and evaluation of a current operation.

MINE1534
Environmental Conditions In Mines
Staff Contact: Dr. V.S. Vutukuri
C3 S1 or S2 HPW3
The energy equation applied to ventilation, sources of heat in mines, geothermal gradients, thermodynamics, pressure-volume diagrams. Practical aspects of high air temperatures and the control of atmospheric conditions in deep underground mines. Fan design, installation and testing. Psychrometry, ventilation planning. Computer applications. Selected laboratory experiments and network designs.

MINE1544
Rock Excavation and Transportation
Staff Contact: Dr. V.S. Vutukuri
C3 S1 or S2 HPW3
Rock fragmentation drilling, blasting large rounds. Loading techniques, shovels, draglines, bucket wheel excavators, dredges, frontend loaders, tractor scrapers. Operating factors, selection procedures, cost estimating. Materials handling, continuous, semi continuous, batch systems, cost analysis.

MINE3114
Mineral Beneficiation
Staff Contact: Dr. V.S. Vutukuri
C3 S1 or S2 HPW3
Prerequisite: MINE7341 or equivalent

MINE3224
Mineral Beneficiation Technology
Staff Contact: Dr. A.C. Partridge
C8 F HPW4
Prerequisite: MINE3114 or equivalent

MINE3324
Mineral Engineering Laboratory
Staff Contact: School Office
C6 S1 or S2 HPW3
Prerequisite: MINE3114 or equivalent
Laboratory investigations may be selected from the following according to availability and specialization: metalliferous ore concentration; coal preparation; beneficiation of nonmetallics; processing of mineral fluids.

MINE3514
Mineral Beneficiation Plant Design
Staff Contact: Dr. A.C. Partridge
C3 S1 or S2 HPW3
Prerequisite: MINE7342 or MINE3114 or their equivalent
Process design based upon mineral properties; extraction processes and environmental conditions. Selection of technology to be adopted. Basis of feasibility studies. Special considerations for coal preparation and treatment of industrial minerals. Flowsheet planning, solid and fluid flows, auxiliary units, materials handling, product disposal. Experimental techniques used in testing. Scale up procedures. Plant control, automation, use of computers. Management of mineral processing operations.

MINE3614
Minerals Engineering 1
Staff Contact: Dr. V.S. Vutukuri
C6 S1 L3 T4

MINE3624
Minerals Engineering 2
Staff Contact: Dr A.C. Partridge
C6 S1 L4 T4


MINE3634
Minerals Engineering Laboratory
Staff Contact: Dr A.C. Partridge
C3 S1 T3

A series of laboratory investigations relating to material covered in subjects MINE3614 and MINE3624

MINE3644
Minerals Engineering 3
Staff Contact: Dr A.C. Partridge
C6 S2 L4 T4


MINE3654
Minerals Engineering Project
Staff Contact: Dr A.C. Partridge
C9 F HPW4.5

Laboratory work to evaluate information necessary for the design of a process for the beneficiation of ore from a metalliferous deposit, preparation of coal or treatment of industrial minerals. Candidate's report to include a process flowsheet, an equipment and materials flowsheet and a plant design layout.

MINE4424
Mineral Industry Analysis
Staff Contact: Dr V.S. Vutukuri
C3 S1 or S2 L2 T2

Aspects of micro and macroeconomics. Type of companies, private, public, noliability, State ownership and participation. Financing of mining ventures. Contracts and project assessment. Obsolescence and replacement. Operations research control networks, decision analysis, linear programming, queuing theory, simulation, improvisation. Grade control, estimation of cutoff grades. Includes advanced work in the technical and economic analysis of mining or mineral operators. Cases are selected for examination and analysis; critical review.

MINE4055
Numerical Methods in Geomechanics
Staff Contact: Dr J.D. Watson
C3 S1 or S2 HPW3

**Boundary Value Problems:** Equivalent continuum, equilibrium in terms of stresses, boundary conditions, displacement and strain, constitutive relations of elasticity, differential equations. **Finite Elements:** Approximate solution and variational principle, stiffness matrix and equivalent nodal force vector, finite elements, assembly and solution of the global system, isoparametric and infinite elements, pre and postprocessing, elastoplasticity, groundwater flow, modelling strategy, programming considerations. Geotechnical applications. **Boundary Elements:** Basic singular solution, indirect method, direct method, isoparametric and infinite elements, construction and solution of system of equations, programming considerations, geotechnical applications.

MINE4155
Stability of Slopes
Staff Contact: Dr A.K. Bhattacharyya
C3 S1 or S2 HPW3

Data collection for pit slope design, statistics of defects in rock masses: Length, orientation, spacing, roughness,

MINE4555
Mining Geomechanics Project
Staff Contact: Dr J.O. Watson
C12 F HPW6

Individual project on an investigation related to an actual mining geomechanics problem, the topic to be chosen after consultation with a staff member. A report is required.

MINE5064
Minor Project
Staff Contact: Dr V.S. Vutukuri
C6 F HPW3

This subject will comprise a literature-based review and a thesis presentation requiring interpretative skills. Experimental work is preferable but not essential. Projects may be based on mining, geology, mineral processing or engineering aspects of industrial processes.

MINE5124
Project
Staff Contact: Dr V.S. Vutukuri
C12 F HPW6

A critical literature review and an experimental program or laboratory work to prove an hypothesis or produce a technical report at a professional level. The report must either be a conventional bound thesis or a combination of covered report, program disks and drawing suitable for permanent library storage. Projects may be based on mining, geology, mineral processing or engineering aspects of industrial processes.

MINE5155
Rock Mechanics Measurements
Staff Contact: Dr V.S. Vutukuri
C3 S1 or S2 HPW3


MINE5184
Major Project
Staff Contact: Dr V.S. Vutukuri
C18 F HPW9

As for MINE5124 Project, but this will comprise a critical literature review accompanied by a comprehensive experimental program of a substantial nature and an interpretative thesis. The candidate is encouraged to seek industrial support for the practical work.

MINE5255
Strata Control Engineering
Staff Contact: Dr V.S. Vutukuri
C3 S1 or S2 HPW3


MINE5324
Principles of Mining Engineering
Staff Contact: Dr V.S. Vutukuri
C6 F L2 T1

Office, workshop, stores and materials handling layout for mines. Layout of shafts, declines and main drives for optimum mineral recovery. Review of underground mining techniques for coal and metalliferous mines with emphasis on cost control and efficient operation. Surface mining techniques, design and layout of haul roads and stripping benches. Dragline and shovel operation. Effect of ventilation requirements and drainage on mine layouts. Scheduling for equipment transfer, maintenance and installation (e.g. longwall face transfers, underground crusher stations, dragline overhaul). Computer software for mine and plant maintenance and management.

MINE5355
Mine Fill Technology
Staff Contact: A/Prof E.G. Thomas
C3 S1 or S2 HPW3


MINE5455
Advanced Rock Cutting Technology
Staff Contact: Prof F. Roxborough
C3 S1 or S2 HPW3


MINE5555
Blasting Technology
Staff Contact: A/Prof G.C. Sen
C3 S1 or S2 HPW3

Key Centre for Mines

KCME1102
Mine Safety Management
Staff Contact: Prof J. Cross
C3
The course includes the following: safety management; hazard and risk analyses, safety hazard identification, management techniques (MORT STEP), safety audits; statistics; HAZOP management and maintenance of change risk analysis; cost benefit analysis; attitudes to safety in mining; safety and personal problems; effective training; accident and injury report/recovery; ergonomics and safety engineering; prevention of traumatic injury; work stress; environmental factors; monitoring and protection; personal protective equipment; safety policies and programs; action plans.

KCME1103
Drilling and Blasting
Staff Contact: Dr G. Sen
C3
Drilling methods, types of drills, types of bits and other accessories, drilling economics, maintenance schedules for drills and accessories; history and theory of explosives, explosive types; new developments and applications; blast design and secondary blasting; controlling ground vibration; airblast and flyrock; blasting economics; controlled blasting; precautions against extraneous electricity; misfires and deteriorated explosives safety and legislation for storage; transportation and handling of explosives.

KCME11105
Slope Stability for Surface Mining
Staff Contact: Centre Office
C3
This comprehensive course will deal with the major topics of engineering geology and groundwater controls, in the form of discontinuities, variable materials and pore pressures. Effect of excavation method and scheduling in pit stability. The fundamental basis of stability analysis, advantages and disadvantages of a range of mathematical models, remedial measures that can be taken to stabilise slopes. Pit slope design in the context of overall mine planning. In addition to dealing with the underlying principles, the subject may involve workshops and field inspections so that the participants gain hands-on experience of practical cases.

KCME11106
Soil and Rock Construction Materials
Staff Contact: Centre Office
C3
This course provides an introduction to the location, assessment, mining and processing of soil and rock construction materials and to the environmental problems associated with their extraction. The main themes explored include the maximum use of existing quarries, the use of upgraded marginal materials and the reclamation of quarried lands. The materials covered include aggregates, ballast, armour-stone and prepared road base, sand, gravel and natural pavement materials, artificial aggregates and stabilised road base, brick clay, limestone and cementitious materials.
KCME1107
Introductory Computing and Statistics for Geologists andMining Engineers
Staff Contact: Dr D. Cohen
C3
Computer hardware for geological data processing; peripheral devices; operating systems; VAX/VMS, IBM, VM/XA, MS DOS, UNIX; programming in Fortran and C; statistics for geologists and mining engineers; data base packages and macros.

KCME1108
Applied Structural Geology
Staff Contact: Dr P.G. Lennox
C3

KCME1300
Mining Management Project
Staff Contact: A/Prof G.R.Taylor
C12
A study of either an administrative or technical nature with relevance to the management of a mining or mineral processing operation. This may be based on simulated or actual situations but projects of relevance to the candidates employment will be encouraged. As far as is possible projects will be designed in consultation with the mining industry.

KCME1302
Mine Ventilation and Environment
Staff Contact: Mr V.S.Vutukuri
C3
The course includes the following topics: ventilation network analysis and simulation; fan selection; role of booster fans; ventilation of long headings; recirculation; gases from diesel engines and their control; methane and its control in underground coal mines; dust in mine air and its control; mine climate and its control; ventilation planning. Subject to be delivered as a short course consisting of 35 hours of class contact and additional tutorials equivalent to a further 7 hours of class contact.

KCME1400
Mining Management Project
Staff Contact: A/Prof G.R.Taylor
C9
A study of either an administrative or technical nature with relevance to the management of a mining or mineral processing operation. This may be based on simulated or actual situations but projects of relevance to the candidate's employment will be encouraged. As far as possible, projects will be designed in consultation with the mining industry.

KCME2101
Strata Control
Staff Contact: Prof R. Singh
C3
This course presents to the practising engineer the latest developments in the field of strata mechanics and develops a sound design background to enable the carrying out of efficient mining operations for increased productivity consistent with safety. The course covers the fundamentals of strata mechanics together with advanced topics including engineering technology and rock mechanics aspects of coal mining strata control. Emphasis will be given to the various design aspects of mine structures, such as mine pillars, gate roads and long wall mining. The role played by instrumentation in providing for the safe design of the mine opening will be addressed. Special sessions will be devoted to rock and cable bolting techniques and powered support design.

KCME2104
Application of Computers in the Mineral Industry
Staff Contact: Dr E. Baafi
C3
Geostatistical ore reserve estimation on a personal computer; computerised open pit design and planning; mine system simulation using GPSS/PC. An expert system for the mineral industry. Mine ventilation planning on a personal computer, using Lotus 123 spreadsheet to solve mining problems.

KCME2105
Geostatistics and Ore Body Modelling
Staff Contact: Ms S. Border
C3
When to apply geostatistics; brief review of univariate statistics; bivariate statistics and correlation; exploratory data analysis; measures of spatial correlation: the variogram, the covariance; variogram calculation and how to obtain a good variogram; random function models and stationarity; desirable properties of estimators; estimation of variance; dispersion variance and uses; optimal weighted average estimator, ordinary kriging; recoverable reserve estimation, problems and solutions; application examples, coal, copper, gold; blasthole kriging for orewaste selection; geotechnics and the environment.

KCME2107
Mine Water Origin, Inflow, Prediction and Control
Staff Contact: Centre Office
C3
Note/s: This is a short course subject and can be done by correspondence.
This course investigates the origin of mine water, and hydrological and hydrogeological factors affecting mine drainage. The method of predicting mine water inflow and techniques of mine water control will be considered. Pumping tests, surface stability, inflow and calculations of water inflow in open cut operations are studied. Underground mine dewatering techniques, pumps, and pumping systems, mine inundation as well as methods for mine water pollution control and treatment are compared.
KCME3101
Coal Preparation
Staff Contact: Centre Office
C3
Coal characterisation, principles of separation, materials handling, sampling - theory, sampling - equipment and practice, screening and comminution, cleaning of coarse and small coal, water based separation, dense medium separation, cleaning of fine coal, solid liquid separation, theory, cyclones, vacuum and pressure filtration, centrifuges (product and tailing), clarification/thickening practice, pumping, piping, valving, plant design, layout and upgrading, maintenance, control concepts (basic process control, on-stream analysis, overall plant control and optimisation).

KCME3201
Financial Management
Staff Contact: Centre Office
C3
Note/s: May be offered by correspondence.
The course is delivered by correspondence and covers the following topics: financial management, an overview; accounting concepts and the accounting process; financial statements; public sector accounting; corporate accounting; the interpretation of financial statements; the recording of costs; management cost information (1); management cost information (2); the budgeting process.

KCME3202
Management Perspectives
Staff Contact: Centre Office
C3
Note/s: May be offered by correspondence.
The course is delivered by correspondence and covers the following topics: what is management?; managing individuals; managing groups; managing organisations; managing information; managing operations; managing decision making.

KCME3203
Economic Decision Making
Staff Contact: Centre Office
C3
Note/s: May be offered by correspondence.
The course is delivered by correspondence and covers the following topics: introduction to economic concepts demand; supply and the market consumers; firms and market structures; welfare economics and government intervention; international economics; macroeconomics and national income analysis; national economic policy benefit cost analysis and expenditure decisions; business finance.

KCME3204
Management of Innovation
Staff Contact: Centre Office
C3
Note/s: May be offered by correspondence.
The course is delivered by correspondence and covers the following topics: innovation and innovators; technology and innovation; opportunity analysis; marketing and innovation; the business plan; management of innovation; innovations in corporations; maintaining innovations.

KCME3205
Strategic Planning
Staff Contact: Centre Office
C3
Note/s: May be offered by correspondence.
The course is delivered by correspondence and covers the following topics: the nature and scope of strategic management; the practice of strategic management; the mission of the organisation; analysing organisational resources; formulating strategic objectives; generating strategic alternatives; evaluating strategic alternatives; strategic implementation; assessing strategic performance.

KCME3206
Mining Law
Staff Contact: Centre Office
C3
Topics to be covered with course include: definitions of 'minerals'; common law; ownership; Aboriginal land rights; miners' rights and claims; exploration titles; production titles; private land/Crown land; administrative processes; environmental protection and royalties. These topics will be illustrated by reference to a number of case histories.

KCME4102
Placer Technology
Staff Contact: Centre Office
C2
Sources of placer minerals; natural processes producing concentration of placer minerals; nature of placer deposits; trends in placer exploration; placer sampling; reserves calculations; mining methods; processing methods; project evaluation; environmental implications and pollution control technology.

KCME4133
An Introduction to Environmental Geology
Staff Contact: Centre Office
C3

KCME4201
Export Marketing for the Mining Industry
Staff Contact: Ms J. Morgan
C3
Marketing as applied to the mineral industry. Sources and types of market related information. Particular international market characteristics; political, social and economic. Trade barriers, cartels, regional and subregional economic groupings. Marketing to Asia. Buyer behaviour, private and government sectors. Design, conduct and analysis of

KCME4202
Mine Evaluation and Project Assessment
Staff Contact: Mr E. J. Malone
C3
Topics to be covered in the course are: valuation tools and techniques; valuation reports; preliminary investigation; asset determination; impact of financing options; published assessments; feasibility studies; valuation of exploration tenements; residual values of property and plant; variations to value.

KCME4203
Mine Management
Staff Contact: Mr S. Gemmel
C3
The subject covers general management functions, planning, organisation, control, communication, command, coordination, production functions, marketing, financial aspects, personnel, purchasing, public relations, environmental matters, contracts and stock market requirements and implications.

KCME4204
Mineral Exploration Project Management
Staff Contact: Centre Office
C3
This course stresses the need to define the exploration target in order to design appropriate exploration programs and establish criteria for monitoring the effectiveness of the programs. Exploration techniques are reviewed with emphasis on the applicability of specific techniques in particular circumstances, their limitations and the use of orientation work to establish performance criteria. Specific topics include: introduction to program design; review of available techniques; remote sensing techniques; geochemical techniques; airborne geophysical surveys; ground geophysical surveys; data interpretation; reporting and supervision; sequential exploration; definition of drill targets; budgeting and budget management.

KCME4301
Environmental Management for the Mining Industry
Staff Contact: Mr D. O'Neill
C3
Note/s: May be taken as either a Science and Technology or a Business Management Module.
Topics addressed are: environmental regulation as a constraint on business operations; environmental planning and management as a component of overall business planning; financial costs and benefits of environmental management and their timing; environmental risks and uncertainty; integrated design strategies; emission control technologies; formal environmental impact assessment procedures, including public submissions and hearings; lease and licence conditions; compliance with planning and pollution control legislation; developing and using environmental operations manuals; inhouse environmental training programmes; corporate environmental audit procedures; liaison with public and community groups; particular EPM applications in mining, oil, manufacturing, petrochemical, civil engineering and infrastructure, building and construction; coastal management and other industries; EPM issues and concerns in Asia-Pacific nations and the region as a whole. Subject to be delivered as a short course consisting of 35 hours of class contact and additional tutorials equivalent to a further 7 hours of class contact.

KCME4302
Environmental Assessments
Staff Contact: Dr D. R. Cohen
C3
This course is an introduction to methods for assessing existing and potential contamination of industrial sites and mining operations. The course includes elements such as the policy and legal framework of environmental assessments; sources of information on a range of chemical contaminants and recommended exposure limits; the role of the assessor (or auditor). Selected environmental assessment case studies will be considered.
Safety Science is a multidisciplinary activity concerned with the application of engineering principles and the behavioural and health sciences to improve the health and safety of people at work and in their other activities. Safety Science considers the interface between people and technology and incorporates areas of study such as ergonomics, biomechanics, occupational disease, toxicology, educational psychology and engineering safety. The Department offers postgraduate courses leading to the award of the degrees of Master of Environmental Studies, 8045, Master of Applied Science (Ergonomics) 8075, Master of Engineering Science (Industrial Safety), 8545, Master of Safety Science, 8671, Graduate Diploma in Safety Science, 5480, and Graduate Diploma in Ergonomics, 5485. There is also a qualifying course 6347, which allows nongraduates with extensive appropriate work experience to enter the courses leading to a graduate diploma. There are no undergraduate courses in safety science but undergraduate students may take individual subjects from the graduate diploma and masters courses where these are appropriate to their undergraduate course or career. The Department is active in research in the areas of ergonomics, biomechanics, safety engineering, safety management, and occupational toxicology. Opportunities are available for graduate research leading to the degrees of Master of Science, 2775, Master of Engineering, 2695, and Doctor of Philosophy, 1665.

Graduate Study

Course Outlines

8045
Master of Environmental Studies

MEnvStudies

This is a faculty-wide, interdisciplinary course administered by the Department of Safety Science. The course draws from schools, departments and centres throughout the University.

The overall objective of the course is to provide opportunities for students to increase their skills in environmental management by extending their knowledge of environmental systems and processes. The course is one that has practical value which will help the careers of graduates.

The course is designed to study the nature of environmental problems and the methodology of evaluation. Emphasis is placed on the development of relevant skills in environmental analysis and planning.

Entry qualifications. Four-year Honours degree, or equivalent, in a field relevant to environmental studies. Applicants may also be admitted if they have a three-year degree plus another qualification at an acceptable level, or have other professional or academic attainments.

Course requirements. Candidates are required to complete a course totalling 30 credits made up of compulsory
subjects, elective subjects and a project, core subjects (6 credits), elective subjects (12 credits) and a project (12 credits). The structure of the course allows students to pursue specialised interests through the electives and the project, or to develop new areas of expertise.

Some subjects have prerequisites or assumed knowledge which are determined to be necessary for suitable progress through the subject. Students should seek advice from subject co-ordinators if they are in doubt as to whether they are qualified to take a subject.

Credit point values are attached to subject descriptions.

There is a wide range of subjects offered by Schools across the entire University which are suitable for inclusion in the MEnvStudies program.

Students may choose to take electives that:
• reinforce their own areas of expertise; or
• extend their knowledge and skills into new areas.

By carefully combining the choice of subjects, it is possible to create programs which are tailored to the needs of individual students. Examples of such tailored programs include:
• land degradation and rehabilitation;
• environmental information systems;
• water resource management;
• urban environment quality;
• waste water treatment;
• environmental safety.

Other tailored programs can be organised, depending on student needs.

The elective subjects are not exhaustive and students may choose elective studies from all graduate programs available in the Faculty of Applied Science, provided that they meet or can satisfy any necessary prerequisites to enrol. These programs include; Earth Sciences, Planning and Assessment, Pollution, Ecology, Remote Sensing, Water Management, Conservation and Land Management, Urban and Social Environments and Safety Science.

The elective subjects listed below are listed under various themes; other subjects are available within these (and other) themes.

**Core Subjects**

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOG9180</td>
<td>Environmental Planning and Evaluation</td>
</tr>
<tr>
<td>SAFE9272</td>
<td>Environment and Medicine</td>
</tr>
<tr>
<td>SAFE9273</td>
<td>Environment and Law Project</td>
</tr>
<tr>
<td>SAFE9612</td>
<td>12 credit Research Project in Environmental Studies</td>
</tr>
</tbody>
</table>

**Elective Subjects**

- **Pollution**
  - CHEM3311 Environmental Chemistry
  - FUEL5860 Unit Operations in Waste Management
  - FUEL5910 Atmospheric Pollution Control Theory
  - FUEL5920 Practical Aspects of Air Pollution Measurement and Control
  - GEOL9012 Contaminant Hydrogeology

- **Health**
  - SAFE9263 Chemical Safety and Toxicology
  - CIVL9851 Unit Operations in Public Health Engineering
  - CIVL9868 Public Health Science
  - GEOG9230 Population, Health and Environment
  - SAFE9260 Introduction to Occupational Health
  - SAFE9352 Hazard and Risk Analysis
  - SAFE9531 Community Noise Control
  - SAFE9553 Radiation Protection

- **Earth Science**
  - GEOG3011 Pedology
  - GEOG9320 Soil Degradation and Conservation
  - GEOL2072 Environmental Geology
  - GEOL3072 Engineering Geology

- **Biological Systems**
  - BIOS3061 Plant Ecosystem Processes
  - BIOS3071 Conservation Biology and Biodiversity
  - BIOT7081 Environmental Biotechnology
  - GEOG3021 Biogeography
  - GEOG9300 Vegetation Management

- **Water Management**
  - CEIC5630 Industrial Water and Waste Water Engineering
  - CIVL9847 Water Resources Policy
  - CIVL9858 Water Quality Management
  - INDC4110 Water Chemistry
  - GEOG9310 River Management

- **Conservation and Land Management**
  - LAND9010 Environmental Heritage Studies
  - LAND9111 Landscape Planning
  - LAND9212 Landscape Planning Methods
  - LAND9213 Land Systems and Management
  - LAND9214 Visual Landscape Assessment

- **Safety Science**
  - SAFE9523 Machines and Structures Safety
  - SAFE9533 Electrical Safety
  - SAFE9543 Management of Dangerous Materials
  - SAFE9544 Traffic Safety

- **Urban and Social Environments**
  - GEOG3192 Urban and Regional Development
  - GEOG9120 Settlement in Australia
  - SAFE9242 Effective Behaviour in Organizations

- **Information Systems**
  - GEOG9150 Remote Sensing Applications
  - GEOG9160 Directed Problems in Remote Sensing
  - GEOG9210 Computer Mapping and Data Display
  - GEOG9240 Principles of Geographic Information Systems

- **Planning and Assessment**
  - CIVL9888 Environmental Management and Economics
  - GEOG3042 Environmental Impact Assessment
  - PLAN0911 The Organisation of Town Planning

- **Other**
  - GEOG9250 Special Topic
  - SAFE9503 Special Report in Safety Science

*Other subjects may be added on approval of Course Coordinator
All students must undertake an investigative project of 12 credit points. This project is expected to be completed within one University session (that is, six months). Students will require an academic supervisor for the duration of the project.

Projects normally require original research in the collection and analysis of data, leading to the preparation of a report of about 10,000 words. The project can be based in studies carried out at the student's place of work, or at some other suitable location.

The objective of the project is for the student to demonstrate skills in research design, data acquisition and analysis, critical synthesis and presentation of findings.

8075
Master of Applied Science - (Ergonomics)

The Master of Applied Science degree in Ergonomics is multi-disciplinary and is designed to accept students from a range of backgrounds. To provide for a common base of knowledge some students are required to study some preliminary subjects which depend on their background.

Candidates are required to complete a total of 36 credit points, made up of 15 credits points of compulsory subjects, 12 credits points of elective subjects and a 9 credit point Project. For candidates with previous ergonomics qualifications an 18 credit point Project may be undertaken in place of 9 credit points of subjects.

Candidates with a three year degree are admitted first to the Graduate Diploma in Ergonomics but may upgrade to the Master of Applied Science in Ergonomics on satisfactory completion of 18 credit points, 9 of which are transferred to the Master of Applied Science degree.

Preliminary Subjects
Students are required to demonstrate either a satisfactory standard of understanding of all these preliminary subjects, or to pass all of them in addition to the 36 credit points required to fulfil the requirements of the Course.

ANAT6151 Introductory Functional Anatomy
SAFE9011 Principles of Engineering Mechanic
SAFE9012 Statistics for Health & Safety Scientists

Core Subjects
SAFE9260 Introduction to Occupational Health
or
SAFE9211 Introduction to Safety Engineering
PSYC7110 Advanced Ergonomics
SAFE9224 Principles of Ergonomics
SAFE9242 Effective Behaviour in Organisations
SAFE9424 Applied Ergonomics

* Students with an engineering or physics background may take SAFE9213 which covers similar material as SAFE9211.

Electives
BIOM9541 Mechanics of the Human Body
SAFE9211 Introduction to Safety Engineering
SAFE9213 Introduction to Safety Engineering M
SAFE9232 Introduction to Occupational Health & Safety Law
SAFE9260 Introduction to Occupational Health
SAFE9261 Occupational Hygiene
SAFE9262 Occupational Medicine
SAFE9263 Chemical Safety & Toxicology
SAFE9342 Management for Safety
SAFE9343 Innovation, Productivity and Safety
SAFE9352 Hazard & Risk Analysis
SAFE9523 Machines & Structures Safety
SAFE9551 Experimental Biomechanics
SAFE9544 Traffic Safety
SAFE9563 Assessment of the Workplace Environment

Note: Other graduate subjects offered by other Schools may be taken subject to the approval of both the School concerned and the Ergonomics Course Coordinator. Not all elective subjects are offered every year.

Project
Students are required to undertake an investigative project and to present a written report according to guidelines established by the Department. The project will normally be of 9 Credit points value (SAFE9609) although in special cases, for example when a student enters the course with substantial background in the core material, a superior Project of 18 Credit points value (SAFE9618) may be taken.

Projects may be based on studies carried out at the student's workplace, in the Department's laboratories or at any other appropriate place with the agreement of the Ergonomics Course Coordinator.

Each student is required to present progress reports at regular seminars which all Project students are expected to attend. Generally there are at least three seminars in each Session.

8545
Master of Engineering Science (Industrial Safety)

MEngSc

The Master of Engineering Science degree is obtained by satisfactory completion of 30 credits points of study, 12 of which represent a project. The degree is normally completed by one year of full-time study or two years of part-time study. Part time students may undertake the project at their place of work. Candidates may undertake interdisciplinary studies and, subject to approval, are able to take subjects from any school in the Faculty, other Faculties of the University and other universities or institutions. By means of this system, programs of studies best suited to the needs of the candidates may be selected. Before enrolment an applicant should submit an intended program for approval by the school or division offering the majority of the credits to ensure that the prerequisite background held is adequate for all subjects including those taken in other schools or institutions.
Entry to the Master of Engineering Science course requires a degree at Honours level, or at Pass level to a superior standard in a four-year course in Engineering or other approved discipline. This is defined as an average of 65% over the last two years of a full-time course (or last three stages of a part-time course) taken in minimum time. If the degree concerned is not in an acceptable discipline, or was of less than four years full-time study, a bridging or qualifying program is required. This is normally arranged by enrolment in the appropriate graduate diploma with the possibility of transferring to the Masters program after completion of requirements prescribed by the Faculty.

Students undertake 9 credits points of compulsory subjects, and 9 credit points of electives. The electives may be taken from any School in the Faculties of Applied Science or Engineering, subject to the agreement of the Head of School and the Head of the Department of Safety Science. This enables students to extend their specialist knowledge in their own discipline, to undertake additional general management subjects or to extend their studies into the broader area of occupational health, safety and management.

Core Subjects
(3 credits points)
SAFE9213 Introduction to Safety Engineering (M)
SAFE9242 Effective Behaviour in Organisations
SAFE9352 Hazard and Risk Analysis

Project Students must undertake an investigative project of 12 credit points value. Projects may be based on studies carried out at a students place of work, or in the laboratories of the Department, or at any other place by arrangement with the Head of the Department. A range of instrumentation is available in the Department, and liaison can be arranged with industry if students do not have a suitable project at their place of work. Each student is required to present a progress report at regular seminars which all project students are expected to attend. Generally there are at least two such seminars in each Session.

Electives Students may choose postgraduate electives either from the Master of Safety Science course or from other schools in the University. A full list of subjects can be obtained from the various faculty handbooks. The subjects listed below are a selection of subjects related to safety from other schools.

Elective Subjects from other Schools:
(2 credit points)
MECH9325 Fundamentals of Noise
MECH9326 Advanced Noise
MNGT0373 Organizational Design

(3 credit points)
CIVL9726 Construction Law and Professional Practice
ELEC9410 Robotics Automation and Productive Technique
IROB5701 Industrial Relations
MANF9400 Industrial Management
MANF9410 Inspection and Quality Control
MECH9400 Mechanics of Fracture and Fatigue
MINE1224 Mining Engineering Technology
MINE1534 Environmental Conditions in Mines
MINE9164 Atmospheric Pollution and Control (Theory)

Other Subjects from AGSM by arrangement

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8671 Master of Safety Science

MSafetySc

Candidates are required to complete a program totalling 45 credit points made up of 24 credit points of compulsory subjects, 12 credit points of electives and a 9 credit point project. Students are also required to demonstrate either a satisfactory standard of understanding of all the preliminary subjects listed below, or to pass those subjects in addition to the 45 credit programme. This enables students from a wide range of disciplines (such as engineering, science, medicine, physiotherapy and education) to reach an adequate standard of comprehension for studying the compulsory subjects.

Preliminary Subjects
(3 credit points)
ANAT6151 Introductory Functional Anatomy
SAFE9011 Principles of Engineering Mechanics
SAFE9012 Statistics for Health and Safety Scientists
SAFE9122 Computing for Safety Science

Core Subjects
Core subjects, totalling 24 credits, represent the central theme of Safety Science and are compulsory.

(3 credit points)
SAFE9260 Introduction to Occupational Health
SAFE9211 Introduction to Safety Engineering
SAFE9224 Principles of Ergonomics
SAFE9232 Introduction to Occupational Health and Safety Law
SAFE9242 Effective Behaviour in Organisations
SAFE9342 Management for Safety
SAFE9352 Hazard and Risk Analysis

Electives Students are required to take at least 12 credit points from the list below.

(2 credit points)
HEAL9411 Epidemiology

(3 credit points)
BIOM9541 Mechanics of the Human Body
CHEM7325 Toxicology, Occupational & Public Health
SAFE9142 Organisational Communication for Safety
SAFE9424 Applied Ergonomics
SAFE9523 Machines & Structures Safety
SAFE9531 Industrial & Environmental Noise
SAFE9533 Electrical Safety
SAFE9543 Management of Dangerous Materials
SAFE9544 Traffic Safety
SAFE9553 Radiation Protection
SAFE9561 Occupational Health Practice
SAFE9563 Assessment of the Workplace Environment
SAFE9573 Fire and Explosion
SAFE9583 Ventilation

(4 credit points)
LAWS5020 Industrial Safety & Health Law

Students may select as electives up to two graduate subjects offered by other Schools in the University, subject to the approval of the School concerned and the Head of the Department. The following is a selection of approved subjects:
### 5480

#### Graduate Diploma in Safety Science

GradDip

The Graduate Diploma in Safety Science Course consists of three major components, totalling 30 credits points. They are preliminary subjects, core subjects and elective subjects. Some subjects must be taken in a prescribed sequence.

#### Preliminary Subjects

To broaden the base of their previous tertiary studies, students take up to three preliminary subjects from the list below. The selection of these subjects is determined according to previous qualifications and experience. Thus engineers are usually required to include Introductory Functional Anatomy, and students from a health sciences background include Principles of Engineering Mechanics. Students are expected to enter the course with a basic understanding of mathematics, physics and Chemistry. Where this is lacking students must undertake a bridging course.

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANAT6151</td>
<td>Introductory Functional Anatomy</td>
</tr>
<tr>
<td>SAFE9011</td>
<td>Principles of Engineering Mechanics</td>
</tr>
<tr>
<td>SAFE9012</td>
<td>Statistics for Health &amp; Safety Scientists</td>
</tr>
<tr>
<td>SAFE9122</td>
<td>Computing for Safety Science</td>
</tr>
</tbody>
</table>

#### Core Subjects

Core subjects, totalling 18 credits, represent the central theme of safety science and are compulsory.

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
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</thead>
<tbody>
<tr>
<td>SAFE9122</td>
<td>Effective Behaviour in Safety Science</td>
</tr>
<tr>
<td>SAFE9242</td>
<td>Human Behaviour &amp; Safety Science</td>
</tr>
<tr>
<td>SAFE9424</td>
<td>Applied Ergonomics</td>
</tr>
</tbody>
</table>

Elective Subjects

To complete the requisite total of 30 credit points, students are required to select one or more subjects from the list of Electives or Core Subjects presented for the MSafetySc programme. In special cases a 3 credit point Report in Safety Science SAFE9603 may be taken.

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5485

#### Graduate Diploma in Ergonomics

GradDip

The Graduate Diploma in Ergonomics is a multidisciplinary course and is designed to accept students from a range of backgrounds. The course consists of three major components totalling 30 credit points: Preliminary subjects, Core subjects and Electives. All students must take 15 credit points from the Core subjects, with the remainder being selected from the Preliminary and Elective subjects. Some subjects must be taken in a prescribed sequence. Prerequisite subjects are shown below; equivalent prerequisites may be acceptable.

#### Preliminary Subjects

Preliminary subjects are chosen according to the student's first degree. Most health professionals would need to study Principles of Engineering Mechanics but not Introductory Functional Anatomy, while engineers and physicists would study Introductory Functional Anatomy but not Principles of Engineering Mechanics. Statistics for Health and Safety Scientists would be taken only by students who have not completed a suitable statistics subject in their first degree.

Selection of these subjects depends on entry qualifications, and is subject to approval by the Ergonomics Course Coordinator.

<table>
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<td>Statistics for Health &amp; Safety Scientists</td>
</tr>
</tbody>
</table>

#### Core Subjects

Core subjects, totalling 15 Credits, represent the central theme of ergonomics, and are compulsory.

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
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<tbody>
<tr>
<td>SAFE9211</td>
<td>Introduction to Safety Engineering</td>
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<tr>
<td>SAFE9224</td>
<td>Principles of Ergonomics</td>
</tr>
<tr>
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<td>Introduction to Occupational Health &amp; Safety Law</td>
</tr>
<tr>
<td>SAFE9242</td>
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<td>Hazard and Risk Analysis</td>
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</tbody>
</table>
Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

SAFE9011 Principles of Engineering Mechanics
Staff Contact: Prof Jean Cross
C3

SAFE9012 Statistics for Health and Safety Scientists
Staff Contact: Ms Dianne Gardner
C3
The subject is designed to provide an introduction to the theory of statistics and to those statistical techniques which are relevant to planning and management of health and safety services. The subject covers statistical methods which are a prerequisite to the study of epidemiology, risk management, ergonomics and behavioural studies. Topics include analysis of frequency distributions, elementary probability theory, Binomial, Normal and Poisson distributions, elementary sampling theory, statistical decision theory and Hypothesis testing, t test, Chisquare test and elementary correlation theory. Illustrative data is drawn from statistics relevant to health and safety.

SAFE9142 Organizational Communication for Safety
Staff Contact: Dr Ronald Rosen
C3

SAFE9211 Introduction to Safety Engineering
Staff Contact: Dr Ronald Rosen
C3
Assumed knowledge: SAFE9011 or PHYS1022
Note/s: Students with an engineering or physics background may take SAFE9213 which covers similar material.

The engineering improvement of potentially hazardous workplace situations with reference to the following: Basic safety practice; management of dangerous materials; fire and explosion; ventilation; noise control; radiation protection; electrical safety; biosafety, machine dangers and machine guarding; construction safety; transport safety; environmental safety; plant safety assessment.

SAFE9213 Introduction to Safety Engineering M
Staff Contact: Dr Ronald Rosen
C3
Assumed knowledge: SAFE9011 or PHYS1022
The treatment of the following topics covers similar material as SAFE9211, but assumes a basic knowledge of differential calculus. The following workplace topics are considered; safety management, ergonomics, equipment design and task consideration, machine guarding, electrical safety, fire and explosion, management of dangerous materials, ventilation, radiation protection, noise and vibration control, environmental safety, transport safety, safety issues in different industries.

SAFE9224 Principles of Ergonomics
Staff Contact: Dr Kamal Kothiyal
C3
Assumed knowledge: SAFE9011 or PHYS1022
Note/s: A project forms a substantial proportion of the assessment for this subject.

Applied anatomy and kinesiology, anthropometry; application to work place arrangement, seating and bench design, tool and equipment design, lifting techniques,
consumer product and architectural design. Physiological and psychological aspects of work and fatigue; measurement of energy consumption, limits to energy expenditure at work, static muscular fatigue, boredom. Environment effects; natural and artificial lighting arrangements, problems of perception, colour; noise and vibration, heat and ventilation, thermal regulation in humans, criteria for comfort. Person-machine interfaces, displays, machine controls, reaction times, vigilance. Applications of ergonomics to occupational safety and health. Ergonomic research methodology.

SAFE9232
Introduction to Occupational Health and Safety Law
Staff Contact: Head of School
C3

SAFE9242
Effective Behaviour In Organisations
Staff Contact: Ms Dianne Gardner
C3

SAFE9260
Introduction to Occupational Health
Staff Contact: Dr Chris Winder
C3
This subject provides an outline of the inter-relationships between the roles of some of the occupational health and safety disciplines (notably occupational hygiene, occupational medicine, epidemiology and toxicology) as well as studies of some common occupational hazards, their outcomes on health and possible options for workplace control.

SAFE9261
Occupational Hygiene
Staff Contact: Dr Chris Winder
C3
Assumed knowledge: SAFE9260
This subject deals with practical considerations of recognising, evaluating and controlling workplace hazards. Topics include the role of the occupational hygienist; types of workplace hazards (such as particulates, gases and vapours, chemicals, noise, radiation, temperature, biohazards); workplace assessment and monitoring; and methods for the control of hazards (such as ventilation and personal protection).

SAFE9262
Occupational Medicine
Staff Contact: Dr Chris Winder
C3
Assumed knowledge: SAFE9260
This subject provides sessions on significant occupational diseases of the respiratory system, skin, eye, musculo-skeletal system and reproductive system, as well as occupational cancer and infectious diseases. The subject also covers other occupational medicine principles and activities, including assessing risks to worker health, health surveillance, health promotion and rehabilitation.

SAFE9263
Chemical Safety and Toxicology
Staff Contact: Dr Chris Winder
C3
Assumed knowledge: SAFE9260
This subject provides an outline of the toxicological, occupational hygiene and environmental aspects of chemical hazards and exposures.

SAFE9264
Assessment of the Workplace Environment
Staff Contact: Dr Chris Winder
C3
Assumed knowledge: SAFE9261
An experimental and workplace assessment based subject, where students will be required to assess physical and chemical hazards encountered in the occupational environment.

SAFE9265
Occupational Health Practice
Staff Contact: Dr Chris Winder
C3
Assumed knowledge: SAFE9262
A workplace assessment based subject, where students will be required to report on occupational health problems in a number of diverse industrial sites.

SAFE9267
Research Methods in Laboratory Science
Staff Contact: Dr Boban Markovic
C3
Assumed knowledge: SAFE9263
A laboratory based subject which will provide the basic requirements of laboratory based research, especially in chemical safety and applied toxicology. The subject covers literature review, methodology, experimental design, data collection and analysis, discussion and presentation skills. Assessment will be made through preparation of a major project report.

SAFE9272
Environment and Medicine
Staff Contact: Dr Chris Winder
C2
Aspects of medicine bearing upon physiological consequences of pollutants. Metabolic mechanisms; chemical interactions, synergism and antagonism; photosynthesis and phytotoxicity. Ozone depletion and greenhouse effects. Morbidity and mortality surveys. Studies of particular pollutants and environmental contaminants.
SAFE9273
Environment and Law
Staff Contact: Dr Chris Winder
C2
Resources in law for the preservation of the environment.
Types of legislation: local government, town planning, 
environmental and common law; administrative 
infrastructure, problems and actions. The North American 
experience. Economic and sociological factors.

SAFE9342
Management for Safety
Staff Contact: Ms Dianne Gardner
C3
Assumed knowledge: SAFE9242
Management models and structure. The structure and 
responsibilities of a safety manager. Integrating safety into 
the organisation and management systems; cost 
effectiveness of safety programs. Selection and training of 
personnel. Comparison and evaluation of occupational 
health and safety 'off the shelf' data management systems. 
The safety practitioner as change agent.

SAFE9343
Innovation, Productivity and Safety
Staff Contact: Ms Dianne Gardner
C3
Behaviour of people in organisation, Individuals, groups 
and organisations: Planning for innovation and change; 
Dealing with human problems, including resistance to 
change; Human capabilities and limitations in the physical, 
perceptual and cognitive reactions with the operating 
system. The cost benefit of failsafe design (in relation to 
human operators) vs post design training. Operator 
efficiency and operator safety. The human barriers to 
designing and operating the system with these joint 
_priorities. Recent advances in defining and controlling 
human error and their implications for equipment design 
and for management and training systems.

SAFE9352
Hazard and Risk Analysis
Staff Contact: Prof Jean Cross
C3
Assumed knowledge: SAFE9012 (Introductory Statistics)
Causes of accidents and defensive strategies; energy 
storage and transfer; epidemiology of accidents; reduction 
of loss from accidental injury; human factors; the 
environment and accidents. Introduction to risk 
management; quantification of risk: risk benefit concepts. 
System reliability and fault tree analysis in the study and 
control of accidents; Hazan, Hazop and Mort. Study of 
some major accidents; accident investigation and analysis; 
case studies in transport, industry, recreation and the 
home.

SAFE9424
Applied Ergonomics
Staff Contact: Mr Roger Hall
C3
Prerequisite: SAFE9224 at credit level or equivalent
Decision making, vigilance, effects of workload and stress, 
applications to screen-based equipment. Human error in 
relation to human/system interaction. Work systems: the 
systems approach, practical evaluation and redesign of 
work systems. Experimental methodology, experimental 
design in ergonomics, critical evaluation of the literature.

SAFE9523
Machines and Structures Safety
Staff Contact: Dr Kamal Kothiyal
C3
Assumed knowledge: SAFE9011 or PHYS1022
Strength of materials, materials failure. Machinery contact 
dangers; machine guarding; safety during maintenance. 
Materials handling safety; cranes, slings, forklift trucks, 
conveyors. Construction safety; ladders, scaffolds, 
formwork, excavations. Structural failures, fracture, 
pressure vessels, nondestructive testing.

SAFE9531
Industrial & Environmental Noise
Staff Contact: Head of School
C3
The course covers the physical, perceptual and legislative 
aspects of noise in an industrial and environmental context. 
Descriptive properties, propagation, loudness and 
_frequency: Measurement, decibels, Hertz, octaves, time 
and frequency weighting, spectral analysis; Perception, 
loudness, annoyance, phons dB(A) Leq Lbg: Anatomy and 
function of the ear: Industrial deafness, Audiometry 
exercise in measuring hearing levels. Instrumentation, 
metersilters, analysers and sound sources; Propagation in 
different environments, reverberation, free field, behaviour in 
different medium: reflection, absorption, transmission, 
barriers and enclosures; Industrial Noise NSW Hearing 
Conservation regulations, measurement and assessment 
of risk and control of industrial noise. Environmental Noise, 
NSW Noise Control Act. Exercise in the measurement and 
control of environmental noise. Effects of aircraft and traffic 
noise and policy directions. Components of an 
environmental impact statement.

SAFE9533
Electrical Safety
Staff Contact: Prof Jean Cross
C3
Effects of current flow and electric and magnetic fields; 
elementary circuit representation, typical supply situations; 
likely dangerous conditions; static electricity; hazardous 
locations; standards and codes of practice; treatment of 
electric shock. Electrical causes of fire and explosion; 
prevention of electrical accidents.

SAFE9543
Management of Dangerous Materials
Staff Contact: Dr Chris Winder
C3
Assumed knowledge: 1st year Chemistry
This subject covers chemicals legislation, regulatory 
_assessment of chemicals, chemical information 
(labels/MSDS), workplace management of chemical safety 
(Workplace assessment, exposure control, storage of 
chemicals, personal protection, monitoring), emergency 
preparedness, pollution, management of hazardous 
wastes and disposal.

SAFE9544
Traffic Safety
Staff Contact: Mr Roger Hall
C3
This subject aims to provide students with an introduction to nature and scope of road safety and provide an understanding of the interdisciplinary and integrated approach required to implement improvements in roads and traffic safety. Subject areas include identification of road safety problems, strategic planning, road and road environment safety, ergonomics, signals, signs, lighting, road user safety, knowledge, attitudes, compliance and practices, vehicle and equipment safety, road safety school education, road safety campaigns and program evaluation.

SAFE9551
Experimental Biomechanics
Staff Contact: Prof Noel Svensson
C3

Objectives and ethics of biomechanical experimentation, statistical evaluation of results. Experimentation involving movement analysis, exercise physiology, muscular activity, mechanical properties of skeletal materials, anthropometric surrogates.

SAFE9553
Radiation Protection
Staff Contact: Dr Ronald Rosen
C3

Assumed knowledge: SAFE9211 or SAFE9213

Principles and practices of radiation protection for both ionising and non ionising radiation. Radiation physics, detection and measurement; background radiation; biological effects of radiation; dose limits; technical controls for radioactive sources and irradiating apparatus. Codes of safe practice; radiological monitoring and personal dosimetry; storage, transport and disposal of sources; environmental impact; administrative controls; emergency procedures; control of nonionising radiation. Practical work and site visit.

SAFE9561
Occupational Health Practice
Staff Contact: Head of School
C3

Assumed knowledge: CMED9701 and SAFE9261

This subject provides an opportunity for experiential learning in topics related to Occupational Health Practice. Students will visit six diverse industrial sites and centres for occupational health control. Before each visit the student must be aware of the possible health problems specific to that site or centre. A nominated preceptor will be available at each site or centre. Reports on each of these visits will be required; two reports must be substantial. Students enrolled in the Master of Safety Science or Diploma in Safety Science courses, who have paramedical qualifications will be best suited for this subject.

SAFE9563
Assessment of the Workplace Environment
Staff Contact: Dr Keith Post
C3

University entrance level Maths, Physics, Chemistry. (Some knowledge or experience in Occupational Hygiene) Experimental design and practical measurements of the physical and chemical components of the workplace and general environment with reference to their impact upon health and safety. One quarter of the subject is allocated to formal lectures which outline measurement methods, experimental strategies and reporting procedures which are useful for constructing successful measurement programs. In the remaining time students design and carry out a number of practical measurement programs to access and report on the environment in terms of parameters such as noise, toxic dusts, flammable gases, floor friction, strength of materials forces associated with manual tasks, temperature, humidity and radiant heat, lighting, radiation, electromagnetic fields, and vibration.

SAFE9573
Fire and Explosion
Staff Contact: Head of School
C3

Assumed knowledge: SAFE9211 or SAFE9213

Properties of explosive and flammable materials; chemistry and physics of combustion reactions; explosion, detonation and blast waves; fire and smoke behaviour.

SAFE9583
Ventilation
Staff Contact: Head of School
C3

Assumed knowledge: Maths Physics & Engineering Mechanics


SAFE9601
Report in Safety Science
Staff Contact: Dr Chris Winder
A one credit report on a topic in safety science.

SAFE9602
Report In Safety Science
Staff Contact: Dr Chris Winder
A two credit report on a topic in safety science.

SAFE9603
Special Report in Safety Science
Staff Contact: Dr Ronald Rosen
C3

Only for students enrolled in the Graduate Diploma courses.

SAFE9609
Project
Staff Contact: Dr Ronald Rosen
C9

SAFE9612
12 Credit Project in Safety Science or Environmental Studies
Staff Contact: Dr Ronald Rosen (Safety Science)
Staff Contact: Dr Chris Winder (Environmental Studies)
C12

SAFE9618
Project Report
Staff Contact: Dr Ronald Rosen
C18
The University has established Centres to encourage research and teaching in areas not readily covered by the established programs in Schools and Faculties. Most Centres have concentrated on multidisciplinary fields and have focussed on new initiatives in the expansion of teaching, research and professional services in specialised areas. The majority of Centres are formed within a School or Faculty or groups thereof although some operate as autonomous units.

The Faculty of Applied Science has ten Centres either located within relevant Schools or in association with other Faculties.

Bioengineering Centre
Centre for Membrane and Separation Technology
Centre for Minerals Engineering
Centre for Particle and Catalyst Technologies
Centre for Petroleum Engineering Studies
Centre for Remote Sensing and Geographic Information Systems
Energy Research, Development and Information Centre (ERDIC)
Food Industry Development Centre
Key Centre for Mines
UNSW Groundwater Centre

Three Centres offer programs which have their own subject identifier. They are the Centre for Minerals Engineering (MINP), the Centre for Petroleum Engineering Studies (PRTL), and the Key Centre for Mines (KCME). The subjects for the Centre for Minerals Engineering are located with the subjects for the School of Chemical Engineering and Industrial Chemistry, those for the Key Centre for Mines are located with the School of Mines. The Centre for Petroleum Engineering Studies has a separate entry in this handbook at the end of this section.

In addition the Faculty of Applied Science is actively involved with seven Co-operative Research Centres (CRCs) established under the Commonwealth Government’s program of CRCs announced in 1991. These are:

- Australian Maritime Engineering CRC
- CRC for Aerospace Structures in which the School of Materials Science and Engineering has a strong involvement.
- CRC for Biopharmaceutical Research in which the Department of Biotechnology has a leading role.
- Australian Petroleum CRC in which the Centre for Petroleum Engineering Studies has a leading role.
- CRC for Waste Management and Pollution Control in which the School of Chemical Engineering and Industrial Chemistry has a major supporting role. The Department of Biotechnology is also involved in the Centre’s projects.
- CRC for Food Industry Innovation in which the Departments of Biotechnology and Food Science and Technology have leading roles.
- Premium Quality Wool CRC in which the School of Wool and Animal Sciences is one of the core partners. The School’s principal involvement is in the education program of the CRC.
Bioengineering Centre

Director:
Professor P. Gray

The Bioengineering Centre is located in the Department of Biotechnology within the School of Applied Bioscience. Its aim is to provide a focus for the application of recombinant DNA and bioengineering techniques to research related to the development of useful products and processes. The Centre brings together expertise in molecular biology, cloning and expression, growth and product recovery from recombinant cells and characterisation and computer modelling of protein structure.

Additional activities of the Centre include continuing education programs and extensive collaborations with local and overseas organisations with similar interests.

Centre for Membrane and Separation Technology

Directors:
Professor H.G.L. Coster (Biophysics Group)
Professor A.G. Fane (Chemical Engineering Group)

The Centre for Membrane and Separation Technology is one of the Australian Government's Commonwealth Special Research Centres established to carry out intensive research into membrane technology. The research programs of the Centre are twofold: to determine the factors underlying the fouling of membranes, particularly ultrafiltration and microfiltration membranes; and to develop biomimetic membranes by implanting biospecies on synthetic membranes.

The Centre is a joint enterprise between the Department of Biophysics in the Faculty of Science and the School of Chemical Engineering and Industrial Chemistry in the Faculty of Applied Science.

Centre for Petroleum Engineering Studies

Director:
Professor W.V. Pinczewski

This Centre is an autonomous unit within the Faculty of Applied Science.

Petroleum Engineering is a specialised engineering discipline which prepares graduates for a career in the oil and natural gas industries and its related operations. Petroleum engineers apply physical, mathematical and engineering principles to identify and solve problems associated with exploration, exploitation, drilling, production, processing, transportation and all the related economic and management problems associated with recovery of hydrocarbons from deep beneath the earth's surface.

The Centre has a four-year course leading to the award of a Bachelor of Engineering in Petroleum Engineering.

Entry is normally into Year 1 of the program. The first two years of the Petroleum Engineering Course are identical to the first two years of the Chemical Engineering Course. The only exception is that Petroleum Engineering students take the whole of Category A General Education subjects in the first year and the whole of Category B General Education subjects in the second year. The University has approved an arrangement whereby, upon recommendation of the Head of School, students who satisfy the requirements of the first two years of the Chemical Engineering, Mechanical
Engineering, Civil Engineering or Mining Engineering degree courses at the University may be admitted into the final two years of the BE degree course in Petroleum Engineering. Such students would complete an appropriately modified Year 3 program as approved by the Head of School.

The University has also approved an arrangement whereby, upon the recommendation of the Head of School, students who satisfy the requirements of the first two years of the Chemical, Mechanical, Civil or Mining Engineering full-time degree courses at any other Australian tertiary institution may be admitted to the final two years of the Petroleum Engineering course. Such students will be required to undertake an appropriately modified Year 3 program as approved by the Head of School. Acceptance into the course will be on the basis of academic merit. This applies equally to students from accredited tertiary institutions in other countries.

For the award of Honours in Petroleum Engineering degree courses, students need to have distinguished themselves in the formal work, in other assignments as directed by the Director of the Centre, and in the final year project, for which a thesis is required.

It is compulsory that, before completion of the course, students in Petroleum Engineering must obtain a minimum of ten weeks' professionally oriented or industrial experience.

Undergraduate Study: Course Outline

### 3045 Petroleum Engineering - Full-time Course

**Bachelor of Engineering**

<table>
<thead>
<tr>
<th>BE</th>
<th>HPW</th>
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#### Year 3

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<tbody>
<tr>
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<td>Social Issues in Applied Science*</td>
<td>S1 2</td>
</tr>
<tr>
<td>CHEN3040</td>
<td>Separation Processes</td>
<td>S2 2</td>
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<td>CHEN3061</td>
<td>Process Plant Engineering 1</td>
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<td>Structures</td>
<td>S1 3</td>
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<tr>
<td>GEOL5301</td>
<td>Introduction to Petroleum Geology</td>
<td>S2 3</td>
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<tr>
<td>GEOL5312</td>
<td>Petroleum Geology &amp; Geophysics</td>
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<tr>
<td>INDC3070</td>
<td>Instrumentation and Process Control</td>
<td>S1 0</td>
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<tr>
<td>MATH3021</td>
<td>Mathematics</td>
<td>S1 2</td>
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<td>PTRL3001</td>
<td>Reservoir Rock Properties and Fluid Flow in Porous Media</td>
<td>S2 2</td>
</tr>
<tr>
<td>PTRL3002</td>
<td>Rock and Fluid Properties Laboratory</td>
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<td>PTRL3003</td>
<td>Petroleum Thermodynamics</td>
<td>S1 2</td>
</tr>
<tr>
<td>PTRL3004</td>
<td>Drilling and Production Laboratory</td>
<td>S2 3</td>
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<tr>
<td>PTRL3006</td>
<td>Drilling Fluids and Cementing</td>
<td>S1 0</td>
</tr>
<tr>
<td>PTRL3007</td>
<td>Reservoir Engineering 1</td>
<td>S2 0</td>
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<tr>
<td>PTRL3009</td>
<td>Fundamentals of Drilling Engineering</td>
<td>S1 2</td>
</tr>
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<td>PTRL3106</td>
<td>Introduction to Formation Evaluation</td>
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<tr>
<td>PTRL3107</td>
<td>Formation Evaluation I</td>
<td>S2 3</td>
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**Total Credits:** 26

#### Year 4

<table>
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<td>CHEN4030</td>
<td>Safety and Environmental*</td>
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<td>CHEN4070</td>
<td>Process Dynamics and Control</td>
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<td>CHEN4088</td>
<td>Design Project</td>
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<td>GEOL5401</td>
<td>Petroleum Production Geology</td>
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<td>Reservoir Simulation</td>
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<tr>
<td>PTRL4002</td>
<td>Advanced Recovery Methods</td>
<td>S2 0</td>
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<tr>
<td>PTRL4003</td>
<td>Well Pressure Testing</td>
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<tr>
<td>PTRL4004</td>
<td>Advanced Drilling Engineering</td>
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<tr>
<td>PTRL4016</td>
<td>Well Completion and Simulation</td>
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<td>Petroleum Production Engineering</td>
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<td>Reservoir Engineering 2</td>
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<td>Formation Evaluation 2</td>
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<td>PTRL4109</td>
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<tr>
<td>PTRL4010</td>
<td>Communication Skills for Engineers</td>
<td>S2 0</td>
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</table>

**Total Credits:** 21

*These subjects contribute towards satisfaction of the Category C General Education requirement.

The Centre also offers courses that cover the areas of Reservoir Engineering, Drilling Engineering, Production Engineering and Formation Evaluation. Suggested course outlines are available from the Director of the Centre.
Undergraduate Study: Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter ‘Handbook Guide’, appearing earlier in this book.

APSE0002
Social Issues in Applied Science
Staff Contact: School Office
S1 L2
The subject covers social issues arising from future technological developments and the role that a professional applied scientist can play in influencing future directions. It will be taught by a combination of group activity, case studies, projects and seminars from visiting speakers, some of whom will be from disciplines other than the applied sciences.

PTRL3001
Reservoir Rock Properties and Fluid Flow in Porous Media
Staff Contact: Dr H.A. Salisch
S1 L2
Prerequisites: CHEN2020, MATH2021

PTRL3002
Rock and Fluid Properties Laboratory
Staff Contact: Dr H.A. Salisch
S1 T3
Prerequisites: CHEN2010, CHEN2020
An integrated reservoir engineering and formation evaluation laboratory incorporating experiments in porosity, permeability, capillary pressure and resistivity of reservoir rocks and PVT properties of crude oil.

PTRL3003
Petroleum Thermodynamics
Staff Contact: Dr I.J. Taggart
S1 L2
Prerequisite: CEIC2030

PTRL3004
Drilling and Production Laboratory
Staff Contact: Dr S.S. Rahman
S2 T3
Prerequisites: CHEN2010, CHEN2020
The program includes measurement and control of the basic properties of drilling fluids (density, viscosity, filtration, lubricity and electrochemical properties) and cement slurries (density, viscosity, filtration, thickening time and mechanical properties). The program also includes a workshop on log interpretation.

PTRL3006
Drilling Fluids and Cementing
Staff Contact: Dr S. S. Rahman
S2 L3
Prerequisites: PTRL3001, PTRL3009
Introduction to the basic functions and properties of drilling fluids and cement slurries. Composition and related properties of drilling fluids and cement slurries. Types of equipment and methods used in cementing operations. Drilling fluid displacement and replacement of cement slurries. Drilling hydraulics.

PTRL3007
Reservoir Engineering 1
Staff Contact: Prof A.K. Khurana
S2 L2
Prerequisite: PTRL3001

PTRL3009
Fundamentals of Drilling Engineering
Staff Contact: Dr S.S. Rahman
S1 L2

PTRL3106
Introduction to Formation Evaluation
Staff Contact: Dr H.A. Salisch
S1 L1

PTRL3107
Formation Evaluation 1
Staff Contact: Dr H.A. Salisch
S2 L3
Prerequisites: PTRL3106, GEOL5301
PTRL4001
Reservoir Simulation
Staff Contact: Prof W.V. Pinczewski
S2 L2
Prerequisites: PTRL3007, MATH3021

PTRL4002
Advanced Recovery Methods
Staff Contact: Dr I.J. Taggart
S2 L2
Prerequisite: PTRL3007

PTRL4003
Well Pressure Testing
Staff Contact: Dr I.J. Taggart
S1 L2
Prerequisites: PTRL3007, MATH3021

PTRL4004
Advanced Drilling Engineering
Staff Contact: Dr S.S. Rahman
S1 L3
Prerequisites: PTRL3004, PTRL3006, PTRL3009

PTRL4016
Well Completions and Stimulation
Staff Contact: Dr S.S. Rahman
S2 L2
Prerequisites: PTRL3002, PTRL3004, PTRL3009

PTRL4026
Petroleum Production Engineering
Staff Contact: Dr S.S. Rahman
S2 L2
Prerequisites: PTRL3002, PTRL3004, PTRL3006, PTRL3009
Introduction to multiphase flow in tubing. Design of sucker rod pumping systems. Design of gas lift and other lifting techniques. Design and operation of surface facilities associated with the primary processing of well head fluids: gathering systems, water separation, oil metering, gas dehydration and stripping. Compression. Pumping and pipeline facilities. Surface facilities associated with artificial lift.

PTRL4007
Reservoir Engineering 2
Staff Contact: Prof A.K. Khorana
S2 L2
Prerequisites: PTRL3002, PTRL3003, PTRL3007

PTRL4018
Petroleum Economics 1
Staff Contact: Mr W.G. Minson
S1 L2
Basic elements of profitability analysis. Depreciation, financial statements, interest, time value of money. The financial plan, outside share, planning and scheduling, pricing and costs. Profitability. Criteria, applications of present value profiles, risk and risk adjustment.

PTRL4028
Petroleum Economics 2
Staff Contact: Mr W.G. Minson
S2 L1
Prerequisite: PTRL4018

PTRL4105
Formation Evaluation 2
Staff Contact: Dr H.A. Salisch
F L2
Prerequisites: PTRL3001, PTRL3107

PTRL4109
Petroleum Engineering Project
Staff Contact: Dr. H.A. Salisch
S1 T4 S2 T2
A major design or research project on a problem relevant to petroleum engineering and concluding in the submission of an individual thesis. Projects of relevance to the research efforts in the School plus approved topics of particular interest to industry.
Communication Skills for Engineers

Interviews: preparation, appearance and attitude. Assessing and meeting company needs. Role of a junior engineer in a team environment. Impromptu and prepared presentation skills. Oil companies’ expectations of engineering reports.

Graduate Study: Course Outline

5031 Petroleum Engineering Graduate Diploma Course

Graduate Diploma in Engineering (Petroleum) GradDip

The oil industry has, in the past, employed personnel who, although working as Petroleum Engineers, have no formal qualifications in petroleum engineering. The Diploma Program in Petroleum Engineering is designed to provide these people with a means of obtaining formal qualifications in a short, intensive, full-time study program over one academic year.

The course work, carried out under the guidance and supervision of academic staff of the Centre, and in close co-operation with the oil industry, will incorporate a significant percentage of practical work in major areas of petroleum engineering. Candidates for the program must hold a Bachelor's Engineering or Science Degree and some relevant field experience in the industry. Acceptance into the program is at the discretion of the Director of the Centre for Petroleum Engineering.

The one year (two session) program course consists of the following subjects:

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Name</th>
<th>HPW</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOL5301</td>
<td>Introduction to Petroleum Geology</td>
<td>S1</td>
</tr>
<tr>
<td>GEOL5312</td>
<td>Geology of Petroleum</td>
<td>S2</td>
</tr>
<tr>
<td>PTRL5001</td>
<td>Reservoir Rock Properties</td>
<td>S1</td>
</tr>
<tr>
<td>PTRL5002</td>
<td>Rock and Fluid Properties</td>
<td>S2</td>
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<td>PTRL5003</td>
<td>Well Pressure Testing</td>
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<td>PTRL5004</td>
<td>Reservoir Simulation</td>
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<td>PTRL5009</td>
<td>Fundamentals of Drilling</td>
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<td>PTRL5012</td>
<td>Drilling Fluids and Cementing</td>
<td>S1</td>
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<tr>
<td>PTRL5106</td>
<td>Introduction to Formation</td>
<td>S2</td>
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<td>PTRL5107</td>
<td>Formation Evaluation</td>
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<td>PTRL5109</td>
<td>Petroleum Engineering Project</td>
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Graduate Study: Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter ‘Handbook Guide’, appearing earlier in this book.

PTRL5001 Reservoir Rock Properties and Fluid Flow in Porous Media


PTRL5002 Rock and Fluid Properties Laboratory

An integrated reservoir engineering and formation evaluation laboratory incorporating experiments in porosity, permeability, capillary pressure and resistivity of reservoir rocks and PVT properties of crude oil.
PTRL5003
Well Pressure Testing
Staff Contact: Dr U. Taggart
S1 L2

PTRL5004
Reservoir Simulation Fundamentals
Staff Contact: Prof W.V. Pinczewski
S2 L2

PTRL5005
Petroleum Thermodynamics
Staff Contact: Dr I.J. Taggart
S1 L2

PTRL5016
Well Completion and Stimulation
Staff Contact: Dr S.S. Rahman
S2 L2

PTRL5007
Reservoir Engineering
Staff Contact: Prof A.K. Khurana
S2 L2

Centre for Remote Sensing and Geographic Information Systems

Director:
Dr A. P. Skidmore

Deputy Director:
Professor J. C. Trinder

The Centre for Remote Sensing and Geographic Information Systems is a joint multidisciplinary enterprise of the Faculty of Applied Science and the Faculty of Engineering.
Graduate Programs in Geographic Information Systems

Master of Applied Science in Geographic Information Systems Course 8024

The Masters degree program in Geographic Information Systems is offered in both Geography and Geology within the Faculty of Applied Science. Entry into either discipline depends on the background of the applicant and the orientation of the proposed program. Detailed information on this course is listed under the School of Geography section in this handbook.

The Masters degree program is also offered in the Faculty of Engineering as a Master of Surveying Science Course 8651. This course has a stronger engineering bias.

Graduate Programs in Remote Sensing

The graduate programs in Remote Sensing are offered in both the Faculty of Applied Science and the Faculty of Engineering. Entry into either Faculty depends on the background of the applicant and the orientation of the proposed program.

Programs are available leading to the award of:
Master of Applied Science in Remote Sensing Course 8026
Graduate Diploma in Remote Sensing Course 5026

Detailed information on these courses is listed under the School of Geography and the School of Geology Sections in this handbook.

Food Industry Development Centre

Director:
Dr P. Cranston

This is a Commonwealth Key Centre located in the Department of Food Science and Technology within the School of Applied Bioscience. The Centre focuses on research and training and most importantly liaison with the Australian food industry.

Key Centre for Mines

Director:
Associate Professor G.R. Taylor

The Key Centre is a joint initiative of the Universities of New South Wales and Wollongong. Funded by the Department of Employment, Education and Training. The purpose of the Key Centre for Mines is to provide a full range of educational and research services to the minerals industries.

Particular emphasis is being placed on continuing education, distance learning and industry based research and development.

The industry sector being addressed by the Key Centre for Mines covers the exploration, extraction, and primary processing of mineral resources.

Information on the Centre's courses is detailed under the School of Mines section in this handbook.

Energy Research, Development and Information Centre (ERDIC)

Director:
Associate Professor G. D. Sergeant

ERDIC provides a contact point for energy researchers at UNSW and acts as a focus for enquiries and consultations on energy technologies. The Centre organises seminars, workshops and meetings and has brought multidisciplinary teams together to work on energy projects. ERDIC has put together a twelve unit subject on Energy Management which is offered as a subject in the Master of Business and Technology.

UNSW Groundwater Centre

The Groundwater Centre was established in 1987 as a Federal National Centre (Centre for Groundwater Management and Hydrogeology). In 1992, the Centre was reorganised as a joint initiative of the Department of Applied Geology in the Faculty of Applied Science and the School of Civil Engineering in the Faculty of Engineering with the general objectives of improving and continuing teaching and research in groundwater studies.

The Centre offers specialised graduate courses in Groundwater Studies and carries out general teaching in Hydrogeology to Applied Science and Engineering postgraduate students.

Information on the Centre's courses is detailed under the Department of Applied Geology, School of Mines, section in this handbook.
Servicing Subject Descriptions

Descriptions of all subjects are presented in alphanumeric order within organizational units. For academic advice regarding a particular subject consult with the contact for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

The following subjects are offered by other Faculties at UNSW, and contribute as either part of courses contained in this handbook, or as electives.

ACCT1501
Accounting and Financial Management 1A
Staff Contact: School Office
S1 or S2 L2 T2

This is the first unit in a sequence of subjects dealing with aspects of the practice of financial reporting. This subject reviews the analytical and investigative tools and processes used within the discipline of accounting, including the basic accounting process, whereby financial data from source documents are recorded, processed, summarised and adjusted (in terms of a given set of accounting concepts) and culminating in the preparation of financial reports. Also the design of accounting systems and incorporation of internal controls; accounting for cash, debtors, inventories and property, plant and equipment; uses and limitations of traditional financial reports.

ACCT1511
Accounting and Financial Management 1B
Staff Contact: School Office
S1 or S2 L2 T2
Prerequisite: ACCT1501

The second unit in a sequence of financial accounting subjects. Includes: the definition and recognition of assets, liabilities, revenues and expenses; partnerships; joint ventures and corporations; financing decisions and financial management; financial statement analysis; aspects of the contemporary institutional and regulatory environment of external financial reporting; alternative accounting systems incorporating different measurement unit capital maintenance and valuation concepts; an overview of accounting for investments; preparation of simple funds statements.

ACCT2522
Accounting and Financial Management 2A
Staff Contact: School Office
S1 L2 T2
Prerequisites: ACCT1511
Note/s: Excluded ACCT2532.

This subject looks at the design and operation of management accounting systems, including product costing systems and budgeting, planning and control systems. In particular, attention is focused on the theoretical and practical implications of management accounting system design on organizational functioning, with emphasis on both manufacturing and service organizations. Involves the use of spreadsheet modelling and the use of personal computer.

ACCT2542
Accounting and Financial Management 2B
Staff Contact: School Office
S2 L2 T2
Prerequisite: ACCT1511
Note/s: Excluded ACCT2552.

The third financial reporting unit after ACCT1501 and ACCT1511 with a consideration of more complicated transactions and events as well as the accounting problems in certain specific industries. Looks at: the contracting cost and other frameworks for the analysis of financial reporting; more advanced aspects of accounting for shareholders' equity, liabilities and assets including interperiod company tax allocation and lease accounting; accounts of a company; Profit and Loss account, balance sheet, and summary of sources and applications of funds; and the application of computer technology to financial accounting problems.

ACCT5940
Auditing
Staff Contact: School Office
S1 or S2 L3
Prerequisite: ACCT5970 or equivalent

Selected aspects of auditing. Topics include: auditing standards and responsibilities, problems of verification and reporting; organization and application to various forms of accounting systems including computer-based systems; appraisal of methods of internal control; the applicability of particular audit techniques including statistical sampling.

ACCT5956
Management Planning and Control
Staff Contact: School Office
S2 L3

Planning and control processes in organizations, and the involvement of management and management support personnel with them. Topics include: 'formal' and 'organizational' perspectives on management planning and control; planning and decision-making in organizations –
some alternative perspectives and descriptions; planning and budgeting - theoretical perspectives and organizational descriptions; organization structures and structuration; control processes in organizations — some alternative perspectives; participation as a mode of organizational control; accounting control systems - some alternative perspectives; designing management accounting systems - prescription or organizational choice; categorizing and evaluating the literatures on management planning and control.

Business-government relations, industry policy and Australian political ‘futures’.

Banking and Finance

FINS2613
Business Finance 2A
Staff Contact: School Office
S1 or S2 L2 T1
Prerequisites: ACCT1511, ECON1102 and ECON1203
Looks at the essential aspects of financial decision-making in business including: factors influencing capital expenditure decisions; alternative approaches to valuation; factors affecting the formulation of the capital structure; influence of the capital market environment.

FINS5517
Portfolio Analysis and Management
Staff Contact: School Office
S1 or S2 L3
Prerequisite: FINS5513
Management of equity and fixed interest portfolios using modern market-based methods of risk control. Derivative instruments: forwards; futures; options; swaps; FRA’s etc. Equity investments: valuation; diversification; portfolio insurance; program trading; international diversification and hedging; performance measurement. Fixed interest portfolios: term structure; duration; convexity; gap analysis; hedging. Alternative assets.

Australian Graduate School of Management

MNGT0204
Macroeconomics for Managers
Recommended: MNGT0200 or MNGT0206 or consent of instructor
Macroeconomics studies the behaviour of aggregate economic activity relating to output, employment and prices in periods of boom and slump. Special emphasis is placed on the performance of the Australian economy. The course is not designed to make you a professional macro-economist but rather to equip you as a manager with sufficient knowledge to cope with major fluctuations in the economy. Examples drawn from several countries.

MNGT0373
Organizational Design
Prerequisite: MNGT0270 or consent of instructor
Extends the structural analysis of organizations introduced in MNGT0270 or equivalent. Topics include power, informal organization, management-by-objectives, entrepreneurship, compliance systems and structural change dynamics. Situational factors considered include the product life cycle and technology. Problems discussed include oligarchy, difficulties flowing from large size and from capital intensive, vertical integration.

MNGT0385
Business-Government Relations
The relationship between business and government in Australia in historic and comparative contexts. Covers the emerging business government issue agenda, developments in the institutions mediating

Biochemistry and Molecular Genetics

BIOC2312
Principles of Biochemistry and Molecular Biology
Staff Contact: Dr K. Moon
U2 F HPW6
Prerequisites: BIOS1011 and BIOS1021, CHEM1101 and CHEM1201 or CHEM1002
Note/s: Excluded BIOC2101, BIOC2372, CHEM2929. Enrolment in this unit may be subject to quota restrictions. Such restrictions will only apply to students taking this unit as an elective part of their program.

BIOC3121
Molecular Biology of Nucleic Acids
Staff Contact: A/Prof A. Mackinlay
U1 S1 HPW6
Prerequisites: BIOC2312, CHEM2021 or CHEM2041
Note/s: Excluded 41.102, 41.102A.

Detailed analysis of gene structure and function including: structure and properties of polynucleotides such as DNA and RNA; structure of chromatin; mechanisms and regulation of gene replication, transcription and translation; recombinant DNA technology, nucleic acid sequencing, DNADNA and DNARNA hybridisation as important tools of modern molecular biology; protein production using recombinant DNA systems. Practical work illustrates and complements the lectures and provides experience with contemporary biochemical techniques.

BIOC3281
Recombinant DNA Techniques and Eukaryotic Molecular Biology
Staff Contact: A/Prof A. Mackinlay
U1 S2 HPW6
Prerequisite: BIOC3121
Note/s: Excluded 41.132, 41.102E.

The organisation of the genomes of higher organisms derived mainly from the application of recombinant DNA technology and related techniques. Methods used for the isolation, identification and characterisation of eukaryotic genomes in terms of the organisation of single copy and repeated sequences and of coding and noncoding sequences and of several gene clusters, eg the alpha and beta globin gene cluster. Mechanisms known to operate in the control of eukaryotic gene expression, both at the DNA level and at the level of RNA processing. Review of several specialised genetic systems in plants and animals such as mitochondria, chloroplasts and RNA and DNA tumour viruses. Practical work provides training in the use of sterile techniques and in working with polynucleotides under nucleasefree conditions, using basic techniques such as hybridisation and DNA sequencing.

BIOC3111
Molecular Biology of Proteins
Staff Contact: Dr G. King
U1 S1 HPW6
Prerequisites: BIOC2312, CHEM2021 or CHEM2041
Note/s: Excluded 41.102, 41.102A.

Modern aspects of the structurefunction relationships of proteins including discussion of the latest techniques of protein characterisation. Topics include: separation and analytical procedures; determination of amino acid sequence data; the nature of proteinprotein and protein ligand interactions including aspects of substrate binding, enzyme kinetics and enzyme mechanisms; the molecular architecture of proteins from the standpoint of the relationships among primary, secondary, tertiary and quaternary structures; aspects of protein engineering. Practical work illustrates and complements the lectures and provides experience with modern techniques of protein molecular biology.

BIOC3271
Cellular Biochemistry and Control
Staff Contact: Dr M. Edwards
U1 S2 HPW6
Prerequisite: BIOC2312

Cell biology from a molecular viewpoint. Biochemical aspects of cellular organisation and how they are integrated and controlled. The arrangement of the component molecules of organelles, their function in integrated cellular metabolism and the molecular interactions between the cells of multicellular organisms. The biochemistry of the cytoskeleton, carriers and intracellular transport systems. The regulation of cellular processes at the molecular and endocrine level. Growth and differentiation. Aspects of cancer metabolism, the biochemistry of cell to cell communication and the structure and function of the extracellular matrix. Complementary to BIOS3141 Ultrastructure and Function of Cells and students with a special interest in cell biology are encouraged to take both subjects. Practical work amplifies the lectures.

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Biomedical Engineering

BIOM9541
Mechanics of the Human Body
Staff Contact: Prof N.L. Svensson
C3 SS L2 T1
Prerequisites: BIOM9510 and ANAT2111

Statics and dynamics of the musculoskeletal system: mathematical modelling and computer simulation, analysis of pathological situations.

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Biological Science

Biological Science Registration Centre
(for courses in Botany and Zoology)

This will be held in Biology Lab A (Room G20, Biological Science Building) as follows:

8-11 Feb 1000-1700
14-18 Feb 1000-1700
21-25 Feb 1000-1700
(late closing 9 and 16 Feb - 2100)

Students must obtain practical slots at that time for:

BIOS2011 Evolutionary and Physiological Ecology
BIOS2021 Introductory Genetics
BIOS2051 Flowering Plants
BIOS2061 Vertebrate Zoology
BIOS3071 Conservation Biology and Biodiversity

Pre-enrolment or enrolment in another faculty does NOT automatically entitle you to a place in your chosen practical time. You must obtain a seat from the Biological Science Registration Centre.

Students enrolling in other subjects do not need to sign on at the Biological Science Registration Centre but only need to attend the first lecture of the relevant course for practical assignments and further details. The location and timetable of lectures and practicals for all subjects in the School of Biological Science (Botany and Zoology) can be obtained from the Biological Science Registration Centre or from the notice boards on the fifth floor of the Biological Sciences Building.
BIOS1011
Biology A
Staff Contact: Dr M.L. Augee
U1 S1 HPW6
Prerequisites: HSC Exam Score Required: 2 unit Science (Physics) 53100, or 2 unit Science (Chemistry) 53100, or 2 unit Science (Geology) 53100, or 2 unit Science (Biology) 53100, or 3 unit Science 90150, or 4 unit Science 150
Notes: The course guide is available for purchase during enrolment week. Equipment required for practical classes is listed in the Course Guide and must be purchased before session starts. Students must consult it for details of the course and assessments.

The biology of cells; their structure as seen with light and electron microscopes; how they move, take in and excrete substances; their chemistry and use of energy. Inheritance and mutations; genes and how they work. The theory covered in the lectures and tutorials is illustrated by observation and experiment in laboratory classes.

BIOS1021
Biology B
Staff Contact: Dr M.L. Augee
U1 S2 HPW6
Prerequisites: BIOS1011

The evolution, diversity and behaviour of living things and the ways in which they have adapted to varying environments. Emphasis on the structure and function of flowering plants and vertebrate animals, and their roles in Australian ecosystems. The theory covered in lectures and tutorials is illustrated by observation and experiment in laboratory classes, which include dissection of a toad and a rat.

BIOS2011
Evolutionary and Physiological Ecology
Staff Contact: Dr P Steinberg
U1 S1 HPW6
Prerequisites: BIOS1011 and BIOS1021

Introduction to functional relationships between living organisms and environments in which they live. Emphasis on interactions within and between populations, ecological energies, ecophysiology, and the theory of evolution by natural selection. Plants, animals and microbes are covered. Also serves content as an introduction to the process of scientific enquiry.

BIOS2021
Introductory Genetics
Staff Contact: Dr W. Sherwin, Dr A. Wilton
U1 S2 HPW6
Prerequisites: BIOS1011 and BIOS1021
Corequisite: BIQC2312
Note/s: Enrolment in this unit may be subject to quota restrictions. Such restrictions will only apply to students taking this unit as an elective part of their program.


BIOS2031
Biology of Invertebrates
Staff Contact: A/Prof P. Greenaway
U1 S2 HPW6
Prerequisites: BIOS1011 and BIOS1021
Note/s: Enrolment in this unit may be subject to quota restrictions. Such restrictions will only apply to students taking this unit as an elective part of their program.

A comparative study of morphology, taxonomy, functional biology and evolutionary relationships of invertebrates. Emphasis on major phyla and marine forms. Practical work includes anatomy of living and preserved specimens (including dissections) and a compulsory field camp. Personal expenses will be incurred.

BIOS2051
Flowering Plants
Staff Contact: A/Prof A. Ashford
U1 S2 HPW6
Prerequisites: BIOS1011 and BIOS1021

Basic plant biology including cell structure, plant morphology and anatomy, water and sugar transport, seed structure and physiology, plant growth and development, arborescence, leaves and photosynthesis, roots, microorganisms and nutrition, evolution of land plants and plant taxonomy. Practical work: plant anatomy and light microscopy; collection of numerical data and a statistical analysis, plant identification.

BIOS2061
Vertebrate Zoology
Staff Contact: Dr M. Augee
U1 S1 HPW6
Prerequisites: BIOS1011 and BIOS1021

Introduction to functional relationships between living organisms and environments in which they live. Emphasis on interactions within and between populations, ecological energies, ecophysiology, and the theory of evolution by natural selection. Plants, animals and microbes are covered. Also serves content as an introduction to the process of scientific enquiry.

Comparative study of the Chordata, with particular reference to the vertebrates, including morphology, systematics, evolution and natural history, with reference to selected aspects of physiology and reproduction. Practical work to supplement lectures. Participations in field excursions is compulsory. Personal expenses will be incurred.

BIOS3014
Ecological Studies in Arid Lands Management
Staff Contact: Dr D Croft
S2 L2 T4

Techniques in ecological studies of animal communities. Adaptations to an arid environment, environmental and social determinants. Behaviour, diet and condition of native and feral animals. Competition between native and introduced herbivores. Strategies in the management of arid zone wildlife. Concurrent studies in relevant units in the School of Biological Science are prescribed to cover aspects of vegetation description and plant environment interactions.
BIOS3061
Plant Ecosystem Processes
Staff Contact: Dr R. McMurtrie
U1 S1 HPW6
Prerequisites: BIOS1011 and BIOS102 and any 2 Level II Science subjects
Soil and atmospheric environments in which plants live and their interaction with the environment. Interactions at scales ranging from the microenvironment to the ecosystem; energy and mass transfer over these scales is investigated and modelled. Impacts of global change on vegetation. Exchange of greenhouse gases between atmosphere and biosphere.

BIOS3071
Conservation Biology and Biodiversity
Staff Contact: Dr W. Sherwin
U1 S1 HPW6
Prerequisites: BIOS1011 and BIOS1021, plus any 2 Level II Biological Science subjects
Applications of community biology, population ecology and genetics to management of environmental problems in nature and artificial ecosystems, including Australian examples. Nature and importance of global diversity. Management and design of programs for the conservation of species and ecosystems, including reserves, off site conservation, and computer simulations. Field excursions compulsory.

Chemistry

CHEM1002
Chemistry 1
Staff Contact: Dr P. Chia
U2 F HPW6
Prerequisites: HSC Exam Score Range Required: 2 unit Mathematics 55100, or 3 unit Mathematics 150, or 4 unit Mathematics 1100 and 2 unit Chemistry 53100, or 3 unit Science 90150, or 4 unit Science 150, or 2 unit Physics 53100
Note/s: CHEM1002 is the normal prerequisite for Level II Chemistry.

CHEM1101
Chemistry 1A
Staff Contact: Dr P. Chia
U1 S1 HPW6
Prerequisites: HSC Exam Score Range Required: 2 unit Mathematics 55100, or 3 unit Mathematics 150, or 4 unit Mathematics 1100 and 2 unit Chemistry 53100, or 3 unit Science 90150, or 4 unit Science 150, or 2 unit Physics 53100

CHEM1201
Chemistry 1B
Staff Contact: Dr P. Chia
U1 S2 HPW6
Prerequisite: CHEM1101
Note/s: The two subjects CHEM1101 and CHEM1201, taken sequentially, are equivalent to CHEM1002.
Molecular geometry, hybridisation of orbitals. Periodicity of physical and chemical properties of elements and compounds. Organic chemistry, including stereoisomerism.

CHEM1302
Introductory Chemistry
Staff Contact: Dr P. Chia
U2 F HPW6
Prerequisites: HSC Exam Score Range Required: 2 unit Mathematics 55100, or 3 unit Mathematics 150, or 4 unit Mathematics 1100
Note/s: Students who perform very well in CHEM1302 are permitted to continue on to Level II chemistry with the permission of the Head of School of Chemistry.

CHEM1401
Introductory Chemistry A
Staff Contact: Dr P. Chia
U1 S1 HPW6
Prerequisites: HSC Exam Score Range Required: 2 unit Mathematics 55100, or 3 unit Mathematics 150, or 4 unit Mathematics 1100

CHEM1807
Chemistry 1ME
Staff Contact: Dr P. Chia
U1 S1 HPW6
Note/s: excluded CHEM1101, CHEM1201, CHEM1002 Restricted to Course 3681
CHEM2011
Physical Chemistry
Staff Contact: Prof R. F. Howe
U1 S1 or S2 HPW6
Prerequisites: CHEM1002, MATH1032 or MATH1042 or MATH1011 and MATH1021

CHEM2021
Organic Chemistry
Staff Contact: Dr R. Read
U1 F or S2 HPW6
Prerequisite: CHEM1002
Discussion of the major types of organic reaction mechanisms, e.g., addition, substitution, elimination, free radical, molecular rearrangement within context of important functional groups. Introduction to the application of spectroscopic methods to structure determination.

CHEM2031
Inorganic Chemistry and Structure
Staff Contact: Dr N. Roberts
U1 S1 or S2 HPW6
Prerequisite: CHEM1002

CHEM2041
Chemical and Spectroscopic Analysis
Staff Contact: Dr G. Moran
U1 S1 or S2 HPW6
Prerequisites: CHEM1002, MATH1032 or MATH1042 or MATH1011 and MATH1021

CHEM2819
Physical Chemistry for Food and Fibre Science and Technology
Staff Contact: Prof R. F. Rowe
S1 or S2 HPW6
Prerequisites: CHEM1002 or CHEM1101 and CHEM1201 and MATH1042 or MATH1032 or MATH1011 and MATH1021
Note/s: Excluded 02.002A

CHEM2828
Organic and Inorganic Chemistry for Chemical Engineers
Staff Contact: Prof P. Clezy
Discussion of selected types of organic reactions to provide a broad cover of the chemistry of aliphatic and aromatic compounds. Survey of the structures, energetics, bonding, reactions and physical properties, and applications, of selected compounds of main group elements and of lanthanide and dblock transition elements.

CHEM2929
Fundamentals of Biological and Agricultural Chemistry
Staff Contact: Dr P. SouthwellKeely

CHEM2838
Inorganic Chemistry and Structure for Materials Science
Staff Contact: Dr N. Roberts
U1 S1 or S2 HPW5
Prerequisite: CHEM1002

CHEM3021
Organic Chemistry
Staff Contact: A/Prof M. Gallagher
U1 S1 HPW6
Prerequisite: CHEM2021
Synthesis and reactions of the principal types of aromatic heterocyclic systems. Stereochemistry. Synthesis and reactions of carbocyclic systems. Application of spectroscopic methods, e.g., nuclear magnetic resonance, mass spectrometry, to determination of organic structures.
CHEM3121
Synthetic Organic Chemistry
Staff Contact: Prof M PaddonRow
U1 S2 HPW6
Prerequisite: CHEM3021

CHEM3311
Environmental Chemistry
Staff Contact: Dr W. Johnson
U1 S2 HPW6
Prerequisites: CHEM2011, CHEM2041

CHEM3321
Applied Organic Chemistry
Staff Contact: A/Prof N. Cheetam
U1 S1 HPW6
Corequisite: CHEM3021
Polymerisation processes and synthetic polymers; initiators, chain transfer agents, retarders. Pigments and dyestuffs; Basis of colour in organic compounds. Oxidation and reduction processes; theory and industrial importance.

CHEM3829
Organic Chemistry
Staff Contact: Prof D. Black
The spectroscopic identification of organic compounds, free radical chemistry and electroorganic processes, various aspects of the organic industrial processes such as industrial synthesis based on petrochemicals, and organometallic reactions of industrial interest. Selected topics from the dyestuff, pharmaceutical and agricultural industries.

CHEM3926
Instrumental Methods of Food Analysis
Staff Contact: A/Prof G. Crank
Treatment of theory and practice of modern instrumental methods of analysis, with strong emphasis on the analysis of food constituents. Variety of spectroscopic and chromatographic techniques.

CHEM3929
Food Chemistry
Staff Contact: A/Prof G. Crank
Treatment of the chemistry of important food constituents. Topics include: proteins, carbohydrates, fats and oils, vitamins, natural and synthetic pigments essential oils and flavours, importance of water in foods.

CHEM7325
Toxicology, Occupational and Public Health
Staff Contact: A/Prof G Crank
F L1 T3
Important classes of toxic materials found in the environment; treatment of pesticide residues, industrial chemicals of various types, toxic gases, mould metabolites and bacterial toxins occurring in food, carcinogenic substances, toxic metals etc. Effects of these substances on living organisms, particularly people. Practical work: pesticide residue analysis, blood and urine analysis, gas sampling and analysis, trace metal determination and experiments on the animal metabolism of toxic substances.

Civil Engineering

CIVL0616
Structures
Staff Contact: A/Prof V. A Pulmano
S1 L1 T2
Note/s: This is a servicing subject for courses offered by other schools and faculties.

CIVL9726
Legal Studies and Professional Practice
Staff Contact: Prof D.G. Carmichael
C3 SS
Note/s: Not offered in 1994
Nature and sources of law, court procedures, interpretation of documents, evidence, technical opinions, expert witness; company law; duties of an engineer; tort, professional liability; trade practices and consumer legislation; ethics.

CIVL9788
Site Investigations
Staff Contact: Prof R. Fell
C3 S1
Engineering geology mapping and terrain classification. Drilling, trenching and sampling of rock and soil. In-situ testing of soil and rock. Laboratory testing of soil and rock. Assessment of design parameters. Instrumentation to measure pore pressure, stress, displacement.

CIVL9790
Stability of Slopes
Staff Contact: Prof R. Fell
C3 S2
Stability of natural and constructed slopes in civil and mining engineering. Stability analysis; stabilization methods and design; monitoring. Design of slopes in soft ground, soil and rock, and in partially saturated slopes; design of open cut mines. Probabilistic methods.
CIVL9799
Environmental Geomechanics
Staff Contact: Mr G.E. Swarbrick
C3 S2
Dispersive soils, hydrological cycle, partly saturated flow through soils, advective-dispersive transport, acid mine drainage, leachate plumes, design and construction of waste dump covers and liners, site remediation and leachate collection and treatment.

CIVL9847
Water Resources Policy
Staff Contact: Dr J.E. Ball
C3 SS
Note/s: Not offered in 1994
Resource economics, water supply, water demand, multiple objective planning, multiple purpose projects, water law, water administration, case studies.

CIVL9849
Environmental Hydrology
Staff Contact: A/Prof I. Cordery
C3 S1
Total catchment management; water policy; low flows and interaction between hydrology and water quality; land use effects; erosion processes; introduction to pollutant loading estimation (sources); quality models; rainfall impacts on water quality, accuracy of data; introduction to water quality treatment processes.

CIVL9851
Unit Operations in Public Health Engineering
Staff Contact: Mr P.J. Bliss
C3 S1
Theory of physical, chemical, biological, and hydraulic processes used in both water and wastewater treatment. Applications where these are common to both water and wastewater treatment.

CIVL9858
Water Quality Management
Staff Contact: Ms P.A. FitzGerald
C3 SS
Note/s: Not offered in 1994
Fundamental concepts; systems approach to quality aspects of water resource systems; quality interchange systems; quality changes in estuarine, surface, and ground water. Quality management by engineered systems. Economic criteria relating to water use and reuse systems.

CIVL9861
Environmental and Engineering Geophysics
Staff Contact: Dr R.I. Acworth
C3 S1
Introduction to available geophysical techniques. Electrical properties of water, soils, rocks and contaminants over the frequency range 1 Hz to GHz. Electrical conductivity profiling methods resistivity and electromagnetic; electrical resistivity soundings; 2D electrical resistivity field methods and FD modelling. Time domain electromagnetic methods; borehole logging using electrical, electromagnetic, nuclear, caliper and fluid logs. Use of ground probing radar; gravity methods; seismic refraction field techniques and the generalised reciprocal interpretation methods; time domain reflectometry and nuclear methods for soil moisture determination and contaminant investigation. Case studies from groundwater resource, salinity, engineering and contamination fields.

CIVL9868
Public Health Science
Staff Contact: Ms P.A. FitzGerald
C3 SS
Note/s: Not offered in 1994
Impact of water and wastewater treatment on disease transmission. Monitoring methods used for pathogens and indicator organisms, structure and degradation of large molecules, biochemical pathways of anabolism and catabolism and the characterization of microorganisms.

CIVL9875
Hydrological Processes
Staff Contact: A/Prof I. Cordery
C3 S1
Introduction to hydrological cycle and energy balance: meteorology; precipitation processes, interception and infiltration, storm runoff processes, groundwater flow, ET.

CIVL9880
Groundwater Modelling
Staff Contact: Dr R.I. Acworth
C3 S1
Groundwater modelling of porous media, fractured rock and low permeability materials. Analogue, numerical analytical models. Matrix structure and inverse methods, stochastic modelling and characterization of variability, modelling multiphase fluids and regional groundwater flow. Applications to borefield management, saltwater intrusion, mine dewatering, geotechnical problems.

CIVL9888
Environmental Management and Economics
Staff Contact: Prof D.L. Wilkinson
C3 S2
Spectrum of modern environmentalism, sustainable development and urban growth. The structure of the environmental regulatory process. Decision making and management systems; case studies; introduction to microeconomics with reference to environmental issues, sustainable economic growth and zero growth. Environmental costing.

Community Medicine
CMED9600
Disability
Staff Contact: Dr L. Lai
C2
Epidemiology of disabling physical and mental conditions; the nature of disability and handicap (including developmental disability); perceptions of handicap; disabled persons' consumer movement and organization; sociology of disability; social inequality and disability; rehabilitation; community and specialist rehabilitation services; relevant legislation, government services, special needs of disabled persons health accommodation and the physical environment, transport, work, income support, legal rights and public policy.
CMED9604
Alcohol and Drug Related Problems
Staff Contact: Dr L. Lai
C2
Concepts of drug dependence, including pharmacological aspects; management of these problems in primary care; rehabilitation programs, smoking cessation; weight control; social and psychological factors and their impact on the family; drug problems and their impact on the community; public health aspects; population indices and surveillance; control programs; legislation; law enforcement; medical and legal aspects of drug dependence.

CMED9609
Community Genetics
Staff Contact: Dr L. Lai
C2
Brief discussion of essentials of human genetics and new development; role of genetics in community health; individuals at risk; genetic disorders including congenital, chromosomal and single-gene defects; their causes and distribution in different populations; health services comprising genetic counselling, screening, carrier detection, pre-symptomatic diagnosis, prenatal diagnosis, and laboratory investigation, and their planning and funding; support groups as related to types of genetic disorder; basic training of genetics in medicine; education and prevention; social, moral and ethical issues involved in the provision of genetic services.

Computer Science and Engineering

COMP9311
Data Base Systems
Staff Contact: Prof J. Hiller
C3 S1 or S2 HPW3
Prerequisites: Assumed knowledge, familiarity with storage structures
Note/s: Excluded 6.659G, 55.823G
A first subject on data base management systems to be presented at a level appropriate for a graduate subject.

The material to be covered will include a selection from: the relational, hierarchic/network, and inverted file data models; normalisation and the problems of redundancies; views and their updates; high level query languages; distributed systems; deductive data bases; data definitions; application generators.

Economics

Department of Economic History

ECOH2301
Management and Business Development
Staff Contact: Dr J. Perkins
S1 L2 T1
Prerequisite: ECON1102
This subject focuses on: origins, evolution and attributes of modern business enterprise in Australia, Europe, America and Japan; strategy, structure and corporate performance; the economics of organization and the organization of work; theory and analysis of multinationals; integration, diversification and the marketing function; managerial hierarchies; decision management and decision control; entrepreneurship; public policy, social responsibility and the external business environment.

Department of Economics

ECON1101
Microeconomics 1
Staff Contact: Dr N. Warren
S1 or S2 L2 T1.5
Prerequisite: ECON1101
This subject provides an introduction to the analysis of aggregate output, employment and economic growth and their relationship to the policy issues of unemployment, inflation and the balance of payments. Other topics include: social accounting and aggregate income and expenditure analysis; macroeconomic models of income determination; consumption and investment functions; the role of money and financial institutions; interactions between goods and money markets in equilibrium and disequilibrium situations; and an analysis of recent Australian macroeconomic experience.

ECON1102
Macroeconomics 1
Staff Contact: Dr P. Kriesler
S1 or S2 L2 T1.5
Prerequisite: ECON1101
This subject provides an introduction to the analysis of aggregate output, employment and economic growth and their relationship to the policy issues of unemployment, inflation and the balance of payments. Other topics include: social accounting and aggregate income and expenditure analysis; macroeconomic models of income determination; consumption and investment functions; the role of money and financial institutions; interactions between goods and money markets in equilibrium and disequilibrium situations; and an analysis of recent Australian macroeconomic experience.
ECON1103
Microeconomic Principles
Staff Contact: A/Prof T. Parry
S1 L2 T1.5
Prerequisite: HSC minimum mark required - 2 unit
Contemporary English (60-100), or 2 unit General English
(60-100), or 2 unit English (53-100), or 3 unit English (1-50)
Note/s: Excluded ECON1101 and ECON1102.
This subject introduces economics as a social science;
scarcity, resource allocation and opportunity cost;
consumer and producer behaviour as the basis for supply
and demand analysis; introduction to marginal analysis;
applications of supply and demand analysis; efficiency
concepts and market forces.

ECON1104
Macroeconomic Principles
Staff Contact: Ms D. Enahoro
S2 L2 T1.5
Prerequisite: ECON1103
Note/s: Excluded ECON1101 and ECON1102.
This subject provides and introduction to the analysis of
aggregate output, employment and economic growth and
their relationship to the policy issues of unemployment,
inflation and the balance of payments. Also covered are
models of the determination of equilibrium income; an
analysis of the role of financial institutions; and an
introduction to the analysis of macroeconomic policy.

ECON2103
Applied Microeconomics
Staff Contact: Dr G. Fishburn
S2 L2 T1.5
Prerequisite: ECON1102
Note/s: Excluded ECON2101, ECON2121
This subject covers: structural change in the Australian
economy; the effect of different market structures on firms
and consumer welfare; the consequences of market failure
and the effects of government regulation; investment
decisions in the public and private sectors, including the
estimation of future benefits, revenues and costs, the
measurement of consumer and producer surplus; the
economics of non-renewable and other resources; and
Australia's international trade and investment and the
effects of restrictions on international trade and investment.

ECON2104
Applied Macroeconomics
Staff Contact: Dr P. Kriesler
S1 L2 T1.5
Prerequisite: ECON1102
Note/s: Excluded ECON2102, ECON2122
This subject looks at: economic growth and fluctuations in
Australia. Inflation, unemployment and balance of
payments issues; fiscal, monetary, exchange rate and
income policies; changes in the structure of the Australian
financial system and its links with the international
monetary system; and effects of restrictions on capital
markets.

ECON2108
Industry Economics and Australian Industrial Policy
Staff Contact: Dr R. Stonecash
S2 L2 T1
Prerequisite: ECON2101 or ECON2103 or ECON2121
Topics covered include: structure of industry;
inter-relationships between the role of the business firm and
industrial structure; multinational corporations; factors
affecting size, structure and performance such as
economies of scale, barriers to entry, vertical integration,
diversification and mergers, patents, the development and
transmission of technology; industrial policy in Australia
with special reference to competition policy, foreign
investment and mergers, and some specific industry
policies e.g. on motor vehicles, electronics, steel,
petroleum.

ECON2109
Economics of Natural Resources
Staff Contact: Dr G. Waugh
S1 L2 T1
Prerequisite: ECON2101 or ECON2121 or ECON2103
Note/s: Excluded ECON2107.
This subject provides an introduction to the exploitation of
natural resource systems examined within an economic
framework, particularly forestry, fisheries, water, oil and
other minerals. It also looks at policies required to ensure
improved management without overexploitation of these
renewable and non-renewable resources under different
property-right regimes.

ECON2117
Economics of Tourism
Staff Contact: Dr B. Rao
S1 L2 T1
Prerequisite: ECON1102
Topics include: macro and micro economic environments;
factors affecting international and domestic tourism;
tourism forecasting models; economic analysis of projects;
Cost/benefit and related procedures; and the implications
of tourism developments for the community in general.

ECON2127
Environmental Economics and Cost-Benefit Analysis
Staff Contact: Dr G. Waugh
S2 L2 T1
Prerequisite: ECON1101
Note/s: Excluded ECON2107.
This subject considers the main elements of environmental
economics and cost benefit analysis as it relates to the
assessment of environmental issues. Topics include:
pollution and pollution policy; environmental cost-benefit
analysis and economic methods for measuring costs and
benefits; species extinction and irreversibility; environmental
ethics and discounting; the environment and
developing countries; and the sustainable economy.

ECON3115
Economics of Developing Countries
Staff Contact: Dr J. Lodewijk
S1 L2 T1
Prerequisite: ECON1102
Note/s: Not offered in 1994.
**Electrical Engineering**

**ELEC0802**  
**Electrical Power Engineering**  
**Staff Contact:** Dr B. Farah  
**S2 HPW3**  
**Prerequisite:** PHYS1002 or equivalent (PHYS2920 for students in Course 3140)

The course deals with the principles and practice of electrical power apparatus, particularly the transformer, the dc motor and the ac motor. It also covers some of the electronic power converters for power supplies and for control of electrical machinery. The course commences with the basic circuit theory and phasor algebra relevant to the analysis of the above systems and then proceeds to the consideration of distribution of electrical power. It then covers the operation, analyses and characteristics of transformers, dc motors, ac motors and a few semiconductor power converter circuits. Rating and thermal considerations of electrical apparatus are also treated.

**ELEC0805**  
**Electronics for Measurement and Control**  
**Staff Contact:** Dr B. Farah  
**S2 L2 T1**

The use of electronics in mechanical systems and the processing of signals by analog and digital techniques. Revision of basic circuit theory, operational amplifier circuits and filtering. Digital logic using integrated circuits. Microcomputers and Microprocessors. Techniques for A/D and D/A conversion, measurement system interfacing to microprocessors.

**ELEC9410**  
**Robotics, Automation and Productivity Technology**  
**Staff Contact:** A/Prof K.E. Tait  
**C3**

Principles of Robotics relevant to trends in automating the manufacturing process. Such aspects as arm configurations, dynamics and control with relevant sensing methods; assembly and control together with trends in artificial intelligence for Robotics are discussed.

**Health Services Management**

**HEAL9411**  
**Epidemiology**  
**Staff Contact:** Dr Mary-Lou McLaws  
**S1 L2**

Principles and methods of epidemiologic investigation of both communicable and noncommunicable diseases including descriptive, analytic and experimental epidemiology. The distribution and dynamic behaviour of disease in the population; data collection, collation and analysis; consideration of screening surveys; longitudinal and case-control studies, etc. The uses of epidemiology in planning, operation and evaluation of health services.

**Industrial Relations and Organizational Behaviour**

**IROB1701**  
**Industrial Relations 1A**  
**Staff Contact:** Dr B. Ellem  
**S1 or S2 L2 T1.5**  
**Prerequisite:** HSC minimum mark required - 2 unit Contemporary English (60-100), or 2 unit General English (60-100) or 2 unit English (53-100), or 3 unit English (1-50)

This subject provides a multi-disciplinary introduction to a range of important concepts and issues in Australian industrial relations. Topics include: political, social, economic, legal, historical and psychological aspects of the evolution and operation of modern industrial relations; the nature and implications of strikes, lockouts and other forms of industrial conflict and alienation; the structure and policies of State and Federal trade unions, the State labor councils and such peak organizations as the Australian Council of Trade Unions; the employer industrial relations function, management strategies and the structure and policies of employer associations; processes of work rule determination, such as collective bargaining, mediation, conciliation and compulsory arbitration; labour movements; and the role of the various arbitration tribunals and government instrumentalities with respect to industrial relations.

**IROB5701**  
**Industrial Relations A**  
**Staff Contact:** A/Prof B. Dabscheck  
**S1 L3**

Concepts and issues in Australian industrial relations at the macro or systems level, with overseas comparisons where appropriate. Labour movements and the evolution of employee-employer relations in the context of industrialization and change; origins and operations of industrial tribunals at the national and state levels; their instrumentalities; nature of industrial conflict and procedures for conflict resolution such as arbitration and bargaining; national wage policy.

**IROB5901**  
**Organizational Behaviour A**  
**Staff Contact:** Mr J. Holt  
**SS L3**  
**Note/s:** Excluded IROB5906, PSYC7100.

This subject seeks to explain human behaviour within organizations. It draws upon a range of disciplines, but with particular reliance on behavioural sciences of psychology and social psychology and their derived disciplines. Its foci are the individual, the group, and the behavioural processes of organization integration, change and development. Topics covered include personality, perception, attitudes and values, motivation, learning, interpersonal behaviour (and skills), group dynamics, leadership and teamwork, decision-making, power and control, and the behavioural implications of change and development. Wherever appropriate, case examples from Australia will be used. Organization, administrative and management theories and constructs serve as integrating and explanatory frameworks for the subject.
Information, Library and Archive Studies

LIBS0815
Economics of Information Systems
Staff Contact: A/Prof C.J. Maguire
S1 HPW2
Information as a resource. Effects of information technology on work and the distribution of wealth. Copyright, patents, licences and other systems aimed at ensuring appropriability of economic benefits from information. Market research and the pricing and distribution of information products and services.

LIBS0817
Information Storage and Retrieval Systems
Staff Contact: Mrs C.S. Wilson
S2 HPW3
Automatic indexing; Automatic thesaurus construction and maintenance; Online searching and information retrieval; Database construction and database software evaluation; Advanced information retrieval techniques; systems analysis, design and costing; advanced technologies for information storage and retrieval.

Information Systems

INFS1602
Computer Information Systems 1
Staff Contact: School Office
S1 or S2 HPW 4
This subject develops an understanding of the content of Information Systems, the types of Information Systems and the position of Information Systems in Society; Information Systems at an organizational level, typical commercial applications, the systems lifecycle, design concepts, data analysis and models and an introduction to data communications.

INFS2603
Computer Information Systems 2
Staff Contact: School Office
S2 HPW 4
Prerequisite: INFS1602
This subject focuses on system analysis and design: requirements analysis and specification; logical and physical design of business systems; specification and updating of files; man-machine dialogue procedures; and comparison of design methodologies, set within the framework of an actual case study.

INFS5957
Information and Decision Technology
Staff Contact: School Office
S1 HPW4
The role of information and models in managerial decision making and prediction. The role of information systems in decision making. Assessing the value of information systems and the contribution of information in decision making under uncertainty. The role of information in managerial prediction and forecasting. The development of computer based models to support tactical management.

Landscape Architecture

LAND9010
Environmental Heritage Studies
Staff Contact: Ms H. Armstrong
C3
An investigation of the concepts of environmental heritage concerning aspects of landscape architecture and conservation issues. The application of environmental heritage in the fields of planning and design. Investigation of case studies of the natural and cultural environment. Projects to investigate problems of planning and managing heritage environments. Methods of conservation analysis with an emphasis on Australian environments and their history.

LAND9111
Landscape Planning
Staff Contact: Mr D. Crawford
C3 S1 L2 T1
Introduction to the discipline of landscape planning. Explores a range of basic methods and techniques for the collection, analysis, and valuation of landscape resource data. Application of this knowledge in the development of simple landscape planning models. Participation in a planning exercise applying these skills and knowledge using simple computing techniques.

LAND9213
Land Systems and Management
Staff Contact: Ms A. Todd
C3 S2 L1 T2
An investigation of resources and their management in relation to a range of land use types with an emphasis on an ecological approach. Subject material includes consideration of management of cultural as well as natural landscapes. Studies of specific examples relating to the effects of human impacts are included. Methods of conservation and rehabilitation are considered. Field excursions are included.

Law

LAWS5020

Legal Studies and Taxation

LEGT7711
Legal Environment of Commerce
Staff Contact: School Office
S1 or S2 L2 T1
Prerequisite: HSC minimum mark required - 2 unit Contemporary English (60-100), or 2 unit General English (60-100), or 2 unit English (53-100), or 3 unit English (1-50)

This subject looks at the Australian legal system and areas of substantive law relevant to commerce including contract, business organization, employment, commercial arbitration, advertising, trade regulation, civil compensation, discrimination.

LEG7731
Legal Regulation of Marketing and Distribution
Staff Contact: School Office
S1 or S2 L2 T1
This subject examines the regulation of restrictive trade practices and sales promotion; the legal framework of marketing strategy with special reference to anti-competitive practices including collusive activity, exclusive dealing, price discrimination, resale price maintenance, mergers and monopolization and consumer protection law including misleading and deceptive advertising and other unfair practices; consumer credit; product liability; protection of intellectual property.

Manufacturing Management

MANF0420
Production Management
Staff Contact: Dr K. Hoang
S1 HPW6
Manufacturing industry dynamics. Porters Model; bases for competition. Meaning of waste; value adding management. Dynamics of materials flow. Hierarchical planning; MRP; OPT; JIT; maintenance management. Manufacturing performance monitoring.

MANF4420
Management of Manufacturing Systems
Staff Contact: Dr K. Hoang
S1 HPW6 S2 HPW2
Prerequisites: MANF3400, MANF3410, MANF3600
Note/s: Excluded MANF0400, MANF4429, MANF9020.

MANF9400
Industrial Management
Staff Contact: Dr B. Kayis
C3 SS HPW3
Evolution of management thought, the planning process; nature of managerial decision making, organizational structures; managing organizational change, motivation, performance, satisfaction, interpersonal and organizational communication, use of management information systems.

MANF9410
Total Quality Management
Staff Contact: Dr B. Kayis
C3 SS HPW3
Note/s: Excluded MANF4429
Quality control systems, quality assurance, planning for quality, total quality management (TQM) philosophy, implementation of TQM in service and manufacturing industries, national and international standards.

Marketing

MARK2012
Marketing Fundamentals
Staff Contact: School Office
S1 L2 T2
Prerequisites: ACCT1511, ECON1102, ECON1203
Corequisite: MARK2032
This subject provides a conceptual framework for developing and understanding of marketing including the marketing process, marketing environment and marketing planning. It covers product, service, consumer, industrial, global and social aspects of marketing and introduces the marketing mix, market segmentation, positioning and product differentiation.

MARK2052
Marketing Research
Staff Contact: School Office
S2 L2 T2
Prerequisite: ECON1203 or approved substitute, MARK2012
This subject examines the sources and types of marketing information relevant to marketing management. Topics include: problem definition and research design; questionnaire design; sampling; data collection; interpretation and reporting; management control of research including briefing, evaluation of proposals and distinction between research results and marketing implications; the use of continuous research; and new developments in market research.

MARK3073
Brand Management
Staff Contact: School Office
S1 L2 T2
Prerequisite: MARK2012, MARK2042
Note/s: Excluded MARK7073.
This subject provides an overview of marketing planning for products and services with a focus on planning at the brand level. Marketing concepts such as segmentation, differentiation, positioning and product lifecycle will be re-examined from a strategic perspective. The marketing mix will be expanded to address strategies of new product development, pricing, distribution and promotions management. Case analysis will be introduced to develop strategic thinking.
Mathematics

MATH1011
General Mathematics 1B
Staff Contact: School of Mathematics First Year Office
U1 S1 HPW6
Prerequisites: HSC exam score range required: 2 unit Mathematics (60100) or 2 and 3 unit Mathematics (1150) or 3 and 4 unit Mathematics (1200). (2 unit Mathematics in this instance refers to the 2 unit Mathematics subject which is related to the 3 unit Mathematics subject. It does not refer to the subjects Mathematics in Society or Mathematics in Practice. These numbers may vary from year to year.)
Note/s: Excluded MATH1032, MATH1042, ECON2200, ECON2201, ECON2202.

Functions (and their inverses), limits, asymptotes, continuity; differentiation and applications; integration, the definite integral and applications; inverse trigonometric functions; the logarithmic and exponential functions and applications; sequences and series; mathematical induction; the binomial theorem and applications; introduction to probability theory; introduction to 3-dimensional geometry; introduction to linear algebra.

MATH1021
General Mathematics 1C
Staff Contact: School of Mathematics First Year Office
U1 S2 HPW6
Prerequisite: MATH1011
Note/s: Excluded MATH1032, MATH1042, ECON2200, ECON2201, ECON2202.

Techniques for integration, improper integrals; Taylor's theorem; first order differential equations and applications; introduction to multivariable calculus; conics; finite sets; probability; vectors, matrices and linear equations.

MATH1032
Mathematics 1
Staff Contact: School of Mathematics First Year Office
U2 F HPW6
Prerequisites: HSC exam score range required: 2 unit Mathematics (67100) (from 1995 this will be 90100) or 2 and 3 unit Mathematics (100150) or 3 and 4 unit Mathematics (100200) or MATH1011 (2 unit Mathematics in this instance refers to the 2 unit Mathematics subject which is related to the 3 unit Mathematics subject. It does not refer to the subjects Mathematics in Society or Mathematics in Practice. These numbers may vary from year to year.)
Note/s: Excluded MATH1011, MATH1021, MATH1042, ECON2200, ECON2201, ECON2202.

Calculus, analysis, analytic geometry, linear algebra, an introduction to abstract algebra, elementary computing.

MATH1042
Higher Mathematics 1
Staff Contact: School of Mathematics First Year Office
U2 F HPW6
Prerequisites: HSC exam score range required: 3 unit Mathematics (145150) or 4 unit Mathematics (186200) (these numbers may vary from year to year.)
Note/s: Excluded MATH1011, MATH1021, MATH1032, ECON2200, ECON2201, ECON2202.

As for MATH1032 but in greater depth.

MATH2009
Engineering Mathematics 2
Staff Contact: School Office
F HPW4
Prerequisite: MATH1032
Note/s: Restricted to Combined degree courses 3681, 3730.

Differential equations, use of Laplace transforms, solutions by series; partial differential equations and their solution for selected physical problems, use of Fourier series; introduction to numerical methods; matrices and their application to theory of linear equations, eigenvalues and their numerical evaluation; vector algebra and solid geometry; multiple integrals; introduction to vector field theory.

MATH2021
Mathematics 2
Staff Contact: School Office
U1 F HPW2
Prerequisite: MATH1021 (CR) or MATH1032
Note/s: Mathematics MATH2021 is included for students desiring to attempt only one Level II Mathematics unit. If other Level II units in Pure Mathematics or Applied Mathematics are taken, MATH2021 Mathematics is not counted.

Differential equations, use of Laplace transforms, solutions by series; partial differential equations and their solution for selected physical problems, use of Fourier series; multiple integrals, matrices and their application to theory of linear equations, eigenvalues; introduction to numerical methods.

MATH2100
Vector Calculus
Staff Contact: School Office
U.5 S1 or S2 HPW2.5
Prerequisite: MATH1032 or MATH1042
Note/s: Excluded MATH2110.

Properties of vectors and vector fields; divergence, gradient, curl of a vector; line, surface, and volume integrals. Gauss and Stokes' theorems. Curvilinear coordinates.

MATH2120
Mathematical Methods for Differential Equations
Staff Contact: School Office
U.5 S1 or S2 HPW2.5
Prerequisite: MATH1032 or MATH1042
Note/s: Excluded MATH2130.
Introduction to qualitative and quantitative methods for ordinary and partial differential equations. The following topics are treated by example. Ordinary differential equations: linear with constant coefficients, firstorder systems, singularities, boundaryvalue problems, eigenfunctions, Fourier series, Bessel's equation and Legendre's equation. Partial differential equations: characteristics, classification, wave equation, heat equation, Laplace's equations, separation of variables methods, applications of Bessel functions and Legendre polynomials.

**MATH2819**
Statistics SA
*Staff Contact: School Office*
U1 F HPW2
*Prerequisite: MATH1021 or MATH1032*
*Note/s: Restricted to Science students in programs 6832, 6833 and course 3950.*

Probability, random variables, independence. Binomial, Poisson and normal distributions, transformations to normality, estimation of mean and variance, confidence intervals, tests of hypotheses, contingency tables, two sample tests of location, simple and multiple linear regression, analysis of variance for simple models.

**MATH3021**
Mathematics 3
*Staff Contact: School Office*
U1 F HPW2
*Prerequisite: MATH2021*
*Note/s: Excluded any other Level III in Pure Mathematics or Applied Mathematics except for MATH3261.*

Vector calculus; special functions; convolution theorem and applications; complex variable theory; Fourier integrals; Laplace transforms with application to ordinary and partial differential equations.

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### Mechanical Engineering

**MECH0130**
Engineering Drawing and Descriptive Geometry
*Staff Contact: Dr R.A. Platfoot*
SS L1 T3
*Note/s: This is a servicing subject taught within courses offered by other schools and faculties.*


**MECH0330**
Engineering Mechanics
*Staff Contact: Dr R.A.J. Ford*
SS L2 T2
*Prerequisites: As for MECH1300 Engineering Mechanics 1*
*Note/s: Excluded MECH0360, MECH1300. This is a servicing subject taught within courses offered by other schools and faculties.*


**MECH0440**
Engineering Statics
*Staff Contact: Dr R.A.J. Ford*
SS L2 T1
*Prerequisites: As for MECH1300 Engineering Mechanics 1*
*Note/s: Excluded MECH0330, MECH0360, MECH1300.*


**MECH1110**
Graphical Analysis and Communication
*Staff Contact: Mr A.J. Barratt*
S2 L1 T2
*Note/s: Excluded MECH0130, MECH0160.*

Freehand sketching of machine components, standard drawing methods, orthogonal projections and sections for analysis and communication, dimensions, tolerances and conventional symbols. Computer graphics modelling of components, assembly and production of detail drawings.

**MECH1300**
Engineering Mechanics 1
*Staff Contact: Dr K. Zarrabi*
S1 or S2 L2 T2
*Prerequisite: HSC Exam Score Range Required Either 2 unit Science (Physics) 53100, or 3 unit Science 90150, or 4 unit Science multistrand 150 or 2 unit Industrial Arts (Engineering Science) 53100, or 3 unit Industrial Arts (Engineering Science) 150*
*Note/s: Excluded MECH0330, MECH0360. Students who wish to enrol in this subject in courses other than the fulltime courses in Aerospace Engineering, Electrical Engineering, Manufacturing Management, Mechanical Engineering and Naval Architecture can make up for the lack of the prerequisite by work taken in Physics in the first half of the first year.*


**MECH2300**
Engineering Mechanics 2A
*Staff Contact: Dr S.S. Leong*
S1 or S2 L2 T1
*Prerequisites: MATH1032 or MATH1042, MECH1300 or MECH0360*

Kinetics of systems of particles; plane steady mass flow. Plane kinematics and kinetics of rigid bodies: moment of inertia; motion relative to translating and rotating frames of reference; equations of motion; work and energy, impulse movement.
and momentum. Virtual work for static and dynamic systems. Kinematics and kinetics of simple mechanisms.

**MECH2310**  
**Engineering Mechanics 2B**  
*Staff Contact: J.M. Challen*  
S1 or S2 HPW2  
*Corequisite: MECH2300*  

**MECH2600**  
**Fluid Mechanics 1**  
*Staff Contact: Prof G.L. Morrison*  
F L1 T1  
*Prerequisites: MATH1032 or MATH1042, PHYS1919*  

**MECH2700**  
**Thermodynamics 1**  
*Staff Contact: A/Prof E. Leonardi*  
F L1 T1  
*Prerequisites: MATH1032 or MATH1042, PHYS1919*  

**MECH9323**  
**Environmental Noise**  
*Staff Contact: A/Prof K.P. Byrne*  
C3 SS HPW3  
*Prerequisite: MECH4321 or equivalent*  

**MECH9325**  
**Fundamentals of Noise**  
*Staff Contact: A/Prof K.P. Byrne*  
C3 SS HPW3  
*Note/s: Excluded MECH4321, MECH9321*  

**MECH9326**  
**Advanced Noise**  
*Staff Contact: A/Prof K.P. Byrne*  
C3 SS HPW3  
*Prerequisite: MECH4321 or MECH9321 or MECH9325*  
*Note/s: Excluded MECH4322, MECH9322*  
Development of the three-dimensional acoustic wave equation. Applications of the three-dimensional form of the acoustic wave equation in rectangular coordinates, including transmission of plane waves at oblique incidence between media, waves in rectangular ducts, standing waves in enclosures. Applications of the three-dimensional wave equation in cylindrical and spherical coordinates. Basic structural-acoustic interaction.

**MECH9400**  
**Mechanics of Fracture and Fatigue**  
*Staff Contact: Dr K. Zarrabi*  
C3 SS HPW3  
*Note/s: Excluded MECH4400*  

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**Medical Education**

**MEED9102**  
**Educational Process in Small Groups**  
*Staff Contact: Mr G. Roberts*  
C2 S1 HPW2  
How people operate as members and leaders of groups; conditions underlying effective group work in educational planning, teaching and learning, and the provision of health care; basic concepts of group structure. Stress on experiential learning, observation of group process, improving skills in facilitating group learning and designing appropriate learning activities.

**MEED9108**  
**Program Evaluation and Planned Change**  
*Staff Contact: A/Prof A. Rotem*  
C2 S2 HPW2  
Designed to help participants develop skills in planning, conduct and evaluation of educational programs. Includes: preparation of a detailed proposal for evaluation of a program; various decisions and activities undertaken in program evaluation; processes of innovation and change.

**MEED9125**  
**Planning, Conducting and Evaluating Educational Workshops**  
*Staff Contact: A/Prof R. Bandaranayake*  
C1 S1 HPW1  
In an attempt to develop their skills in all aspects of conducting workshops, participants are guided to formulate a plan for a workshop for their colleagues in an important educational area, with opportunity to practise various techniques for enhancing active participation, and
subsequently to conduct the workshop, evaluate its process and outcomes, and report on it.

Microbiology and Immunology

MICR2201
Introductory Microbiology
Staff Contact: Dr I. Couperwhite
U1 S1 HPW6
This introduction to microbiology is offered as a single unit elective. However, the subject is mandatory for students wishing to major in program 4400 Microbiology and Immunology. Students with no previous knowledge of biology can do this subject. A brief bridging course is available for students in this category.

MICR2218
Microbiology
Solely for students enrolled in the Food Technology BSc courses 3060 and 3070 in the Faculty of Applied Science.

MICR3041
Immunology I
Staff Contact: Prof G. Jackson
U1 S1 HPW6
Prerequisite: BIOC2312
Basic immunology and immunological techniques. Topics include innate and adaptive immunity, development of the immune system, induction and expression of the immune response, structure and function of antibodies, antigen antibody reactions, the major histocompatibility complex, aspects of immunology in disease. ANAT2211 Histology 1 at Level II is strongly recommended for students doing Immunology 1.

MICR3051
Immunology 2
Staff Contact: Dr A. Collins
U1 S2 HPW6
Prerequisite: MICR3041
Advanced immunology. Major topics include antigen epitope analysis, processing and presentation, lymphocyte biology, immunogenetics of the molecules of recognition, cytokines, immune regulation, the mucosal immune system, immunity to infectious diseases, vaccine development and clinical immunology.

MICR3071
Environmental Microbiology
Staff Contact: Dr Y. Barnet
U1 S2 HPW6
Prerequisite: MICR2201
Major topics include the complexity of natural habitats, interaction of microorganisms with their environment with an emphasis on evolution and adaptation, environmental monitoring in aquatic and soil habitats, manipulation of microbial populations in natural habitats including problems with the release of genetically engineered microorganisms. Field work is an integral part of this course and students may be required to bear some personal costs.

Physics

PHYS1002
Physics 1
Staff Contact: First Year Director
U2 F HPW6
Prerequisites: HSC Exam Score Range Required: 2 unit Mathematics 67100, or 2 and 3 unit Mathematics (100150), or 3 and 4 unit Mathematics (100200) or (for PHYS1002 only) MATH1011, and 2 unit Science (Physics) 57100, or 2 unit Science (Chemistry) 60100, or 3 unit Science 90150, or 4 unit Science 150 or PHYS1022 (2 unit Mathematics in this instance refers to the 2 unit Mathematics subject which is related to the 3 unit Mathematics subject, and does not refer to the subjects Mathematics in Society or Mathematics in Practice).
Corequisite: MATH1021 or MATH1032.
Motion of particles under the influence of mechanical, electrical, magnetic and gravitational forces. Force, inertial mass, energy, momentum, charge, potential, fields. Conservation principles applied to problems involving charge, energy and momentum. Application of Kirchoff’s laws to AC and DC circuits. Uniform circular motion, Kepler’s laws and rotational mechanics. Properties of matter: solids, liquids, gases. Application of wave theories to optical and acoustical phenomena such as interference, diffraction and polarisation.

PHYS1022
Physics 1 For Health and Life Scientists
Staff Contact: First Year Director
U2 F HPW6
Corequisites. MATH1011 and MATH1021 or MATH1032.
 Principally for students majoring in the life and health sciences disciplines. Topics at an introductory level. The methods of physics, describing motion, the dynamics of a particle, conservation of energy, kinetic theory of gases, properties of liquids, vibrations and waves, electricity and conduction in solids, ionic and ionic conduction, magnetism and electromagnetic induction, alternating current, atomic nature of matter, X-rays, the nucleus and radioactivity, geometrical optics, optical instruments, wave optics, microscopes and their uses.

PHYS1939
Physics 1 (Building and Industrial Design)
Staff Contact: First Year Director
Energy transfer: concepts of temperature and heat; calorimetry; gas laws; phase changes and humidity; heat transmission; refrigeration. Electrostatics and electromagnetism: electric and magnetic fields; DC circuits; electromagnetic induction. Sound: wave properties; absorption of sound. Properties of matter: atomic bond types and their relation to elasticity, plasticity and fracture; pressure in stationary and moving fluids.
PHYS2001
Mechanics, and Computational Physics
Staff Contact: Executive Assistant
U1 S1 HPW4
Prerequisites: PHYS1002, MATH1032.
Corequisite: MATH2100
Note/s: Excluded PHYS2999.

Harmonic motion, systems of particles, central force problems, Lagrange's equations, coupled oscillations, travelling waves, pulses, energy and momentum transfer, computer operating systems, introduction to FORTRAN libraries and software packages, use of computers to solve problems in physics.

PHYS2011
Electromagnetism and Thermal Physics
Staff Contact: Executive Assistant
U1 S2 HPW4
Prerequisites: PHYS1002, MATH1032
Corequisites: MATH2100
Note/s: Excluded PHYS2999.

Electric field strength and potential, Gauss' law, Poisson's and Laplace's equations, capacitance, dielectrics and polarisation, magnetism, electromagnetic induction, Maxwell's equations, electromagnetic waves. Laws of thermodynamics, kinetic theory, microscopic processes, entropy, solid state defects, Helmholtz and Gibbs functions, Maxwell's relations, phase diagrams, chemical and electrochemical potential.

PHYS2021
Quantum Physics and Relativity
Staff Contact: Executive Assistant
U1 F HPW2
Prerequisites: PHYS1002, MATH1032
Corequisites: MATH2100
Note/s: Excluded PHYS2989.


PHYS2031
Laboratory
Staff Contact: Executive Assistant
U1 F HPW3
Prerequisites: PHYS1002, MATH1032
Note/s: Excluded PHYS2920.

Experimental investigations in a range of areas: xray diffraction, work function, semiconductor bandgap, Hall effect, carrier lifetimes, nuclear magnetic resonance, magnetic properties and electrostatics. Electronics bench experiments and tutorials on diodes, transistors, operational amplifiers, power supplies and digital electronics.

PHYS2032
Electronics (Applied Science)
Staff Contact: Executive Assistant
U.5 S1 HPW3
Prerequisite: PHYS1022 or PHYS1002
Note/s: Excluded PHYS2031, PHYS2630.

The application of electronics to other disciplines. Includes principles of circuit theory; amplifiers, their specification and application, transducers; electronic instrumentation; industrial data acquisition.

PHYS3021
Statistical Mechanics and Solid State Physics
Staff Contact: Executive Assistant
U1 S1 HPW4
Prerequisites: MATH2120, PHYS2011, PHYS2021
Canonical distribution, paramagnetism, Einstein solid, ideal gas, equipartition, grand canonical ensemble, chemical potential, phase equilibria, Fermi and Bose statistics, Bose condensation, blackbody radiation. Crystal structure, bonding, lattice dynamics, phonons, freeelectron models of metals, band theory, point defects, dislocations.

PHYS3060
Advanced Optics
Staff Contact: Executive Assistant
U.5 S2 HPW2
Prerequisite: PHYS1002
Corequisite: MATH2120

Review of geometrical optics, including ray tracing, aberrations and optical instruments: physical optics, including Fresnel and Fraunhofer diffraction, transfer functions, coherence, and auto and cross correlation: applications of optics, including fibre optics, lasers and holography.

PHYS3110
Experimental Physics B1
Staff Contact: Executive Assistant
U.5 S1 HPW4
Prerequisite: PHYS2031

Selected experiments and projects. Advanced experimental techniques and open ended projects in the areas covered in PHYS3041 Experimental Physics A together with projects involving electron and nuclear magnetic resonances, low temperature physics and superconductivity. Fourier optics, holography.

PHYS3120
Experimental Physics B2
Staff Contact: Executive Assistant
U.5 S2 HPW4
Prerequisite: PHYS2031

As for PHYS3110 Experimental Physics B1.

PHYS3410
Biophysics
Staff Contact: Executive Assistant
U.5 S2 HPW2
Prerequisites: PHYS2011, PHYS2410


PHYS3710
Lasers and Applications
Staff Contact: Executive Assistant
U.5 S1 HPW2
Note/s: Offered in oddnumbered years only.
Interaction between light and matter, fundamental properties of laser amplifiers and oscillators, giant pulse generation, mode locking and Q switching, specific laser systems including gas lasers and semiconductor lasers, applications of lasers.

Psychology

PSYC7104
Applied Cognitive Psychology
Staff Contact: Dr H Stanislaw
S1 HPW2
Cognitive factors that limit our ability to process information, methods used to cope with these limitations, and the implications for such practical areas as training and artificial intelligence. Topics include memory, reasoning and problem-solving, and performance on motor tasks.

PSYC7110
Advanced Ergonomics
Staff Contact: Mr R Hall (Dept. of Safety Science)
S2 HPW3
Application of ergonomic principles and methods to the design and analysis of work tasks involving a high cognitive component, such as those involving humancomputer interaction.

Surveying

SURV0441
Surveying for Engineers
Staff Contact: School Office
S2 L2 T2.5
Note/s: This is a servicing subject taught within courses offered by other schools and faculties.

SURV0580
Mining Surveying
Staff Contact: School Office
S1 L2 T1
Prerequisite: SURV0441
Note/s: This is a servicing subject taught within courses offered by other schools and faculties.
Revision of traverse, set out and levelling (14 hours field work).

SURV9211
Introduction to Geodesy
Staff Contact: School Office
C3 S1 L2 T1

SURV9213
Physical Meteorology
Staff Contact: School Office
C3 S2 L2 T1

SURV9532
Data Acquisition and Terrain Modelling
Staff Contact: School Office
C3 SS L2 T1

SURV9600
Principles of Remote Sensing
Staff Contact: School Office
C3 S1 L2 T1

SURV9602
Remote Sensing Procedures
Staff Contact: School Office
C3 S2 L2 T1
Review of atmospheric correction procedures and application to multitemporal Landsat MSS data. Review of image registration, enhancement and classification procedures with particular reference to multisource remote sensing data sets. Analysis of techniques over a varied land use area. Land use change project and analysis using multisource and multitemporal remotely sensed imagery, including Landsat MSS, TM, SPOT and SAR.
SURV9604
Land Information Systems
Staff Contact: School Office
C3 SS L2 T1

SURV9605
Field Data Collection and Integration
Staff Contact: School Office
C3 S1 HPW3
The spectral, temporal and spatial characteristics of various surfaces, and the available sensors to effect maximum differentiation. Ground and image comparisons. Instruments available for field measurements. Field investigation procedures including positioning and sampling considerations.

SURV9606
Microwave Remote Sensing
Staff Contact: School Office
C3 S1 HPW3
Use of passive and active (radar) microwave techniques in remote sensing of earth resources. Topics include: real and synthetic aperture radar systems; passive microwave radiometry; energy-surface interactions; interpretation of microwave image data; applications in agriculture, geology, oceanography and hydrology; issues in signal and image processing; characteristics of airborne and spaceborne microwave sensors.

SURV9608
Cadastral Systems
Staff Contact: School Office
C3 SS L2 T1

Town Planning
PLAN0911
The Organization of Town Planning
Staff Contact: School Office
SS
Aims, means and consequences of town planning in Australia. Aims of planning: organization of the environment in respect of space and time, interrelationship of functions, equity of resource distribution, human satisfaction, the nature of the planning approach. Means of planning: overview of the planning process, laws related to planning, planning assessment procedures, environmental management at different levels, decisionmaking processes — financiers', firms' and private decisions, changes in public values, public participation, political and economic constraints. Consequences of planning: illustrative case studies, evaluation of planning methodology and procedures.
Conditions for the Award of Degrees

First Degrees

Rules, regulations and conditions for the award of first degrees are set out in the appropriate Faculty Handbooks.

For the full list of undergraduate courses and degrees offered see Table of Courses by Faculty (Undergraduate Study) in the Calendar.

The following is the list of higher degrees, graduate diplomas and graduate certificates of UNSW, together with the publication in which the conditions for the award appear.

Higher Degrees

For details of graduate degrees by research and course work, arranged in faculty order, see UNSW Courses (by faculty) in the Calendar.

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### Conditions for the Award of Degrees

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### Graduate Diplomas

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### Graduate Certificates

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*Faculty of Science.
†Faculty of Biological and Behavioural Sciences.
Doctor of Philosophy (PhD)

1. The degree of Doctor of Philosophy may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate faculty or board (hereinafter referred to as the Committee) to a candidate who has made an original and significant contribution to knowledge.

Qualifications

2. (1) A candidate for the degree shall have been awarded an appropriate degree of Bachelor with Honours from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Committee.

(2) In exceptional cases an applicant who submits evidence of such other academic and professional qualifications as may be approved by the Committee may be permitted to enrol for the degree.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment as a candidate for the degree.

Enrolment

3. (1) An application to enrol as a candidate for the degree shall be lodged with the Registrar at least one month prior to the date at which enrolment is to begin.

(2) In every case before making the offer of a place the Committee shall be satisfied that initial agreement has been reached between the School* and the applicant on the topic area, supervision arrangements, provision of adequate facilities and any coursework to be prescribed and that these are in accordance with the provisions of the guidelines for promoting postgraduate study within the University.

(3) The candidate shall be enrolled either as a full-time or a part-time student.

(4) A full-time candidate will present the thesis for examination no earlier than three years and no later than five years from the date of enrolment and a part-time candidate will present the thesis for examination no earlier than four years and no later than six years from the date of enrolment, except with the approval of the Committee.

(5) The candidate may undertake the research as an internal student i.e. at a campus, teaching hospital, or other research facility with which the University is associated, or as an external student not in attendance at the University except for periods as may be prescribed by the Committee.

(6) An internal candidate will normally carry out the research on a campus or at a teaching or research facility of the University except that the Committee may permit a candidate to spend a period in the field, within another institution or elsewhere away from the University provided that the work can be supervised in a manner satisfactory to the Committee. In such instances the Committee shall be satisfied that the location and period of time away from the University are necessary to the research program.

(7) The research shall be supervised by a supervisor and where possible a cosupervisor who are members of the academic staff of the School or under other appropriate supervision arrangements approved by the Committee. Normally an external candidate within another organisation or institution will have a cosupervisor at that institution.

Progression

4. The progress of the candidate shall be considered by the Committee following report from the School in accordance with the procedures established within the School and previously noted by the Committee.

(i) The research proposal will be reviewed as soon as feasible after enrolment. For a full-time student this will normally be during the first year of study, or immediately following a period of prescribed coursework. This review will focus on the viability of the research proposal.

*School* is used here and elsewhere in these conditions to mean any teaching unit authorised to enrol research students and includes a department where that department is not within a school, a centre given approval by the Academic Board to enrol students, and an interdisciplinary unit within a faculty and under the control of the Dean of the Faculty. Enrolment is permitted in more than one such teaching unit.
Progress in the course will be reviewed within twelve months of the first review. As a result of either review the Committee may cancel enrolment or take such other action as it considers appropriate. Thereafter, the progress of the candidate will be reviewed annually.

Thesis

5. (1) On completing the program of study a candidate shall submit a thesis embodying the results of the investigation.
(2) The candidate shall give in writing to the Registrar two months notice of intention to submit the thesis.
(3) The thesis shall comply with the following requirements:
(a) it must be an original and significant contribution to knowledge of the subject;
(b) the greater proportion of the work described must have been completed subsequent to enrolment for the degree;
(c) it must be written in English except that a candidate in the Faculty of Arts and Social Sciences may be required by the Committee to write a thesis in an appropriate foreign language;
(d) it must reach a satisfactory standard of expression and presentation;
(e) it must consist of an account of the candidate's own research but in special cases work done conjointly with other persons may be accepted provided the Committee is satisfied about the extent of the candidate's part in the joint research.
(4) The candidate may not submit as the main content of the thesis any work or material which has previously been submitted for a university degree or other similar award but may submit any work previously published whether or not such work is related to the thesis.
(5) Four copies of the thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of theses for higher degrees.
(6) It shall be understood that the University retains the four copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

Examination

6. (1) There shall be not fewer than three examiners of the thesis, appointed by the Committee, at least two of whom shall be external to the University.
(2) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the thesis and shall recommend to the Committee that one of the following:
(a) The thesis merits the award of the degree.
(b) The thesis merits the award of the degree subject to minor corrections as listed being made to the satisfaction of the head of school.
(c) The thesis requires further work on matters detailed in my report. Should performance in this further work be to the satisfaction of the higher degree Committee, the thesis would merit the award of the degree.
(d) The thesis does not merit the award of the degree in its present form and further work as described in my report is required. The revised thesis should be subject to reexamination.
(e) The thesis does not merit the award of the degree and does not demonstrate that resubmission would be likely to achieve that merit.
(3) If the performance at the further work recommended under (2)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to represent the same thesis and submit to further examination as determined by the Committee within a period specified by it but not exceeding eighteen months.
(4) The Committee shall, after consideration of the examiners' reports and the results of any further work, recommend whether or not the candidate may be awarded the degree. If it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate be permitted to resubmit the thesis after a further period of study and/or research.

Fees

7. A candidate shall pay such fees as may be determined from time to time by the Council.
Master of Applied Science (MAppSc) and Master of Environmental Studies (MEnvStudies)

1. The degree of Master of Applied Science or Master of Environmental Studies by formal course work may be awarded by the Council to a candidate who has satisfactorily complete a program of advanced study.

Qualifications

2. (1) A candidate of the degree shall:
   (a) have been awarded an appropriate degree of Bachelor of four full-time years duration (or the part-time equivalent) from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the Faculty of Applied Science (hereinafter referred to as the Committee), or
   (b)(i) have been awarded an appropriate degree of Bachelor of three full-time years duration (or the part-time equivalent) from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Committee and
      (ii) have undertaken appropriate postgraduate studies of the full-time year's duration (or the part-time equivalent) at the University of New South Wales or studies considered equivalent from another university or tertiary institution at a level acceptable to the Committee.
   (2) An applicant who submits evidence of such other academic or professional attainments as may be approved by the Committee may be permitted to enrol for the degree.
   (3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least two calendar months before the commencement of the session in which enrolment is to begin.
(2) A candidate for the degree shall be required to undertake such formal subjects including the submission of a report on a project, and pass such assessment as prescribed. The project shall be under the supervision of an academic staff member and shall be assessed by two examiners (for a major project).
(3) The progress of a candidate shall be reviewed at least once a year by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.
(4) No candidate shall be awarded the degree until the lapse of two academic sessions from the date of enrolment in the case of a full-time candidate and four sessions in the case of a part-time candidate. The maximum period of candidature shall be four academic sessions from the date of enrolment for a full-time candidate, eight sessions for a part-time candidate, and ten sessions for an external candidate. In special cases an extension of these times may be granted by the Committee.

Fees

4. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Engineering (ME) and Master of Science (MSc)

1. The degree of Master of Engineering or Master of Science by research may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate faculty (hereinafter referred to as the Committee) to a candidate who as demonstrated ability to undertake research by the submission of a thesis embodying the results of an original investigation.
Qualifications

2. (1) A candidate for the degree shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Committee.

(2) An applicant who submits evidence of such other academic or professional attainments as may be approved by the Committee may be permitted to enrol for the degree.

(3) When the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant, before being permitted to enrol, to undergo such examination or carry out such work as the Committee may prescribe.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least one calendar month before the commencement of the session in which enrolment is to begin.

(2) In every case, before permitting a candidate to enrol, the head of the school* in which the candidate intends to enrol shall be satisfied that adequate supervision and facilities are available.

(3) An approved candidate shall be enrolled in one of the following categories:
   (a) Full-time attendance at the University;
   (b) Part-time attendance at the University;
   (c) external not in regular attendance at the University and using research facilities external to the University

(4) A candidate shall be required to undertake an original investigation on an approved topic. The candidate may also be required to undergo such examination and perform such other work as may be prescribed by the Committee.

(5) The work shall be carried out under the direction of a supervisor appointed from the full-time members of the University staff.

(6) The progress of a candidate shall be reviewed annually by the Committee following a report by the candidate, the supervisor and the head of the school (or department) in which the candidate is enrolled and as a result of such review the Committee may cancel enrolment or take such other action as it considers appropriate.

(7) No candidate shall be granted the degree until the lapse of three academic sessions in the case of a full-time candidate or four academic sessions in the case of a part-time or external candidate from the date of enrolment. In the case of a candidate who has been awarded the degree of Bachelor with Honours or who has had previous research experience the Committee may approve remission of up to one session for a full-time candidate and two sessions for a part-time or external candidate.

(8) A full-time candidate for the degree shall present for examination not later than six academic sessions from the date of enrolment. A part-time or external candidate for the degree shall present for examination not later than ten academic sessions from the date of enrolment. In special cases an extension of these times may be granted by the Committee.

Thesis

4. (1) On completing the program of study a candidate shall submit a thesis embodying the results of the original investigation.

(2) The candidate shall give in writing two months notice of intention to submit the thesis.

(3) The thesis shall present an account of the candidate’s own research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied about the extent of the candidate’s part in the joint research.

(4) The candidate may also submit any work previously published whether or not such work is related to the thesis.

(5) Three copies of the thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of higher degree theses.

*Or department where a department is not within a school, or schools or departments where the research is being undertaken in more than one school or department.
(6) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

Examination

5. (1) There shall be not fewer than two examiners of the thesis, appointed by the Committee, at least one of whom shall be external to the University unless the Committee is satisfied that this not practicable.

(2) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the merits of the thesis and shall recommend to the Committee that:

(a) the candidate be awarded the degree without further examination; or

(b) the candidate be awarded the degree without further examination subject to minor corrections as listed being made to the satisfaction of the head of the school (or department); or

(c) the candidate be awarded the degree subject to a further examination on questions posed in the report, performance in this further examination being to the satisfaction of the Committee; or

(d) the candidate be not awarded the degree but be permitted to resubmit the thesis in a revised form after a further period of study and/or research; or

(e) the candidate be not awarded the degree and be not permitted to resubmit the thesis.

(3) If the performance at the further examination recommended under (2)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to represent the same thesis and submit to a further oral, practical or written examination within a period specified by it but not exceeding eighteen months.

(4) The Committee shall, after consideration of the examiners' reports and the reports of any oral or written or practical examination, recommend whether or not the candidate may be awarded the degree. If it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate may resubmit the thesis after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Engineering (ME), Master of Science (MSc) and Master of Surveying (MSurv) without supervision

1. The degree of Master of Engineering or Master of Science or Master of Surveying without supervision may be awarded by the Council on the recommendation of the Higher Degree Committee of the appropriate faculty (hereinafter referred to as the Committee) to a candidate who has demonstrated ability to undertake research by the submission of a thesis embodying the results of an original investigation.

Qualifications

2. A candidate for the degree shall have been awarded an appropriate degree of Bachelor from the University of New South Wales with at least three years relevant standing in the case of Honours graduates and four years relevant standing in the case of Pass graduates, and at a level acceptable to the Committee.

Enrolment and Progression

3. An application to enrol as a candidate for the degree without supervision shall be made on the prescribed form which shall be lodged with the Registrar not less than six months before the intended date of submission of the thesis. A graduate who intends to apply in this way should in his or her own interest, seek at an early stage the advice of the appropriate head of school (or department) with regard to the adequacy of the subject matter and its presentation for the degree. A synopsis of the work should be available.
Thesis

4. (a) A candidate shall submit a thesis embodying the results of the investigation.
(2) The candidate shall give in writing to the Registrar two months notice of intention to submit the thesis.
(3) The thesis shall present an account of the candidate's own research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied about the extent of the candidate's part in the joint research.
(4) The candidate may also submit any work previously published whether or not such work is related to the thesis.
(5) Three copies of the thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of theses for higher degrees.
(6) It shall be understood that the University retains the three copies of the thesis submitted for examination and is free to allow the thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the thesis in whole or in part, in photostat or microfilm or other copying medium.

Examination

5. (1) There shall be not fewer than two examiners of the thesis, appointed by the the Committee, at least one of whom shall be external to the University unless the Committee is satisfied that this is not practicable.
(2) Before the thesis is submitted to the examiners the head of the school (or department) in which the candidate is enrolled shall certify that it is prima facie worthy of examination.
(3) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the thesis and shall recommend to the Committee that:
(a) the candidate be awarded the degree without further examination; or
(b) the candidate be awarded the degree without further examination subject to minor corrections as listed being made to the satisfaction of the head of the school (or department); or
(c) the candidate be awarded the degree subject to a further examination on questions posed in the report, performance in this further examination being to the satisfaction of the Committee; or
(d) the candidate be not awarded the degree but be permitted to resubmit the thesis in a revised form after a further period of study and/or research; or
(e) the candidate be not awarded the degree and be not permitted to resubmit the thesis.
(4) If the performance at the further examination recommended under (3)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to represent the same thesis and submit to further examination as determined by the Committee within a period specified by it but not exceeding eighteen months.
(5) The Committee shall, after consideration of the examiners' reports and the results of any further examination, recommend whether or not the candidate may be awarded the degree. If it is decided that the candidate be not awarded the degree the Committee shall determine whether or not the candidate may resubmit the thesis after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Engineering Science (MEngSc)

1. The degree of Master of Engineering Science may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.
Qualifications

2. (1) A candidate for the degree shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the Faculty (hereinafter referred to as the Committee).

(2) In exceptional cases an applicant who submits evidence of such other academic and professional qualifications as may be approved by the Committee may be permitted to enrol for the degree.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar two calendar months before the commencement of the session in which the enrolment is to begin.

(2) A candidate for the degree shall:
(a) undertake such formal subjects and pass such assessment as prescribed, or
(b) demonstrate ability to undertake research by the submission of a thesis embodying the results of an original investigation of an approved topic, or
(c) undertake an approved combination of the above in which case the thesis component shall be referred to as a project report.

(3) The program of advanced study shall total a minimum of 30 credits. The number of credits allocated for each subject shall be determined by the Committee on the recommendation of the appropriate head of school.

(4) A candidate's proposed program shall be approved by the appropriate head of school prior to enrolment. For the purposes of this requirement the appropriate head of school shall normally be the head of the school providing the major field of study.

(5) The progress of a candidate shall be reviewed at least once annually by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(6) No candidate shall be awarded the degree until the lapse of two academic sessions from the date of enrolment in the case of a full-time candidate or four sessions in the case of a part-time candidate. The maximum period of candidature shall be four academic sessions from the date of enrolment for a full-time candidate and eight sessions for a part-time candidate. In special cases an extension of these times may be granted by the Committee.

18 Credit Project Report

4. (1) A candidate who undertakes an 18 credit project shall carry out the work on an approved topic under the direction of a supervisor appointed from the full-time academic members of the University staff.

(2) The candidate shall give in writing to the Registrar two months notice of intention to submit a project report.

(3) The project report or thesis shall present an account of the candidate's own research. In special cases work done conjointly with other persons may be accepted, provided the Committee is satisfied about the extent of the candidate's part in the joint research.

(4) The candidate may also submit any work previously published whether or not such work is related to the thesis.

(5) Three copies of the project report or thesis shall be presented in a form which complies with the requirements of the University for the preparation and submission of project reports and theses for higher degrees.

(6) It shall be understood that the University retains the three copies of the project report or thesis submitted for examination and is free to allow the project report or thesis to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the project report or thesis in whole or in part, in microfilm or other copying medium.
Examination of 18 Credit Project Report

5. (1) There shall be not fewer than two examiners of the project report, appointed by the Committee, at least one of whom shall be external to the University unless the Committee is satisfied that this is not practicable.

(2) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the project report and shall recommend to the Committee that:

(a) the project report be noted as satisfactory; or
(b) the project report be noted as satisfactory subject to minor corrections being made to the satisfaction of the head of the school; or
(c) the project report be noted as unsatisfactory but that the candidate be permitted to resubmit it in a revised form after a further period of study and/or research; or
(d) the project report be noted as unsatisfactory and that the candidate be not permitted to resubmit it.

(3) The Committee shall, after considering the examiners' reports and the candidate's results of assessment in the prescribed formal subjects, recommend whether or not the candidate may be awarded the degree. If it is decided that the project report is unsatisfactory the Committee shall determine whether or not the candidate may resubmit it after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Environmental Studies (MEnvStudies)

See Master of Applied Science above.

Master of Safety Science (MSafetySc)

1. The degree of Master of Safety Science may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.

Qualifications

2. (1) A candidate for the degree shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the Faculty (hereinafter referred to as the Committee).

(2) In exceptional cases an applicant who submits evidence of such other academic and professional qualifications as may be approved by the Committee may be permitted to enrol for the degree.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribe, before permitting enrolment.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the degree shall be made on the prescribed form which shall be lodged with the Registrar at least two calendar months before the commencement of the session in which enrolment is to begin.

(2) A candidate for the degree shall be required to undertake such formal subjects and pass such assessment as prescribed. The program of advanced study shall total a minimum of 45 credits. The number of credits allocated for each subject shall be determined by the Committee on the recommendation of the Course Director (hereinafter referred to as the head of the school).
(3) The progress of a candidate shall be reviewed at least once annually by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(4) No candidate shall be awarded the degree until the lapse of two academic sessions from the date of enrolment in the case of a full-time candidate or four sessions in the case of a part-time candidate. The maximum period of candidature shall be six academic sessions from the date of enrolment for a full-time candidate and ten sessions for a part-time candidate. In special cases an extension of these times may be granted by the Committee.

18 Credit Project Report

4. (1) The program of advanced study may include an 18 credit project on an approved topic.
(2) The work shall be carried out under the direction of a supervisor appointed from the full-time academic members of the University staff.
(3) The candidate shall give in writing to the Registrar two months notice of intention to submit a report on the project.
(4) Three copies of the project report shall be presented in a form which complies with the requirements of the University for the preparation and submission of project reports for higher degrees.
(5) It shall be understood that the University retains the three copies of the project report submitted for examination and is free to allow the project report to be consulted or borrowed. Subject to the provisions of the Copyright Act, 1968, the University may issue the project report in whole or in part, in microfilm or other copying medium.

Examination of 18 Credit Project Report

5. (1) There shall be not fewer than two examiners of the project report, appointed by the Committee.
(2) At the conclusion of the examination each examiner shall submit to the Committee a concise report on the project and shall recommend to the Committee that:
(a) the project report be noted as satisfactory; or
(b) the project report be noted as satisfactory subject to minor corrections being made to the satisfaction of the head of the school; or
(c) the project report be noted as unsatisfactory but that the candidate be permitted to resubmit it in a revised form after a further period of study and/or research; or
(d) the project report be noted as unsatisfactory and that the candidate be not permitted to resubmit it.
(3) The Committee shall, after considering the examiners’ reports and the candidate’s results of assessment in the prescribed formal subject, recommend whether or not the candidate may be awarded the degree. If it is decided that the project report is unsatisfactory the Committee shall determine whether or not the candidate may resubmit it after a further period of study and/or research.

Fees

6. A candidate shall pay such fees as may be determined from time to time by the Council.

Master of Science (MSc)

See Master of Engineering above.

Master of Science (MSc) without supervision

See Master of Engineering without supervision above.
Graduate Diploma (GradDip)

1. A Graduate Diploma may be awarded by the Council to a candidate who has satisfactorily completed a program of advanced study.

Qualifications

2. (1) A candidate for the diploma shall have been awarded an appropriate degree of Bachelor from the University of New South Wales or a qualification considered equivalent from another university or tertiary institution at a level acceptable to the Higher Degree Committee of the appropriate faculty (hereinafter referred to as the Committee).

(2) An applicant who submits evidence of such other academic or professional attainments as may be approved by the Committee may be permitted to enrol for the diploma.

(3) If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require the applicant to undergo such assessment or carry out such work as the Committee may prescribed, before permitting enrolment.

Enrolment and Progression

3. (1) An application to enrol as a candidate for the diploma shall be made on the prescribed form which shall be lodged with the Registrar at least two calendar months before the commencement of the session in which enrolment is to begin.

(2) A candidate for the diploma shall be required to undertake such formal subjects and pass such assessment as prescribed.

(3) The progress of a candidate shall be reviewed at least once annually by the Committee and as a result of its review the Committee may cancel enrolment or take such other action as it considers appropriate.

(4) No candidate shall be awarded the diploma until the lapse of two academic sessions from the date of enrolment in the case of a full-time candidate or four sessions in the case of a part-time candidate. The maximum period of candidature shall be four academic sessions from the date of enrolment for a full-time candidate and six sessions for a part-time candidate. In special cases an extension of these times may be granted by the Committee.

Fees

4. A candidate shall pay such fees as may be determined from time to time by the Council.
The scholarships and prizes listed below are available to students whose courses are listed in this book. Each faculty handbook contains in its Scholarships and Prizes section the scholarships and prizes available with that faculty. The General Information section of the Calendar contains a comprehensive list of scholarships and prizes offered throughout the University. Applicants should note that the awards and conditions are subject to review.

Key: V Value T Year/s of Tenure C Conditions

Scholarships

Undergraduate Scholarships

Listed below is an outline in summary form of undergraduate scholarships available to students. Full information may be obtained from the Student Centre located on the Lower Ground Floor of the Chancellery. Unless otherwise indicated in footnotes, applications for the following scholarships should be made to the Registrar and Deputy Principal by 14 January each year. Please note that not all of these awards are available every year.

General

Australian Development Corporation

V Tuition fees. Some students may be eligible for airfares and a stipend.

T Determined by normal course duration

C Information should be obtained from Australian Diplomatic Posts. Conditions and entitlements vary depending on the home country. The closing date is normally early in the year before the year of study.

Sam Cracknell Memorial

V Up to $1500 pa payable in fortnightly instalments

T 1 year

C Prior completion of at least 2 years of a degree or diploma course and enrolment in a full-time course during the year of application; academic merit; participation in sport both directly and administratively; and financial need.

Girls Realm Guild

V Up to $1500 pa

T 1 year with the prospect of renewal subject to satisfactory progress and continued demonstration of need

C Available only to female students under 35 years of age who are permanent residents of Australia enrolling in any year of a full-time undergraduate course on the basis of academic merit and financial need.

W.S. and L.B. Robinson

V Up to $6500 pa

T 1 year renewable for the duration of the course subject to satisfactory progress

C Available only to students who have completed their schooling in Broken Hill or whose parents reside in Broken Hill; for a course related to the mining industry. Includes courses in mining engineering, geology, electrical and mechanical engineering, metallurgical process engineering, chemical engineering and
science. Applications close 30 September each year. Apply directly to PO Box 460 Broken Hill NSW 2880

Alumni Association
V Up to $1500 pa
T 1 year with the possibility of renewal
C Available to students enrolled in any year of a full-time course. Candidates must be the children of Alumni of the University of NSW and may be either permanent residents of Australia or international students.

Sporting Scholarships
V $2000 pa
T 1 year with possibility of renewal
C Available to students who are accepted into a course of at least two years duration. Prospective applicants should have an outstanding ability in a particular sport and are expected to be an active member of a UNSW Sports Club. Apply directly to Sport and Recreation Section, The University of New South Wales, Kensington NSW 2052.

General Accident Australian Bicentennial St Andrews Scholarship
V £Stg4840
T approximately 12 months
C Applicants should be Australian citizens who are proceeding to Honours in Economics, History, Philosophy, Economic and Social History or Social Anthropology. The awards are for study at St Andrews, United Kingdom.

Applied Science
Malcolm Chalkin Foundation Scholarship
V Up to $8000 pa
T 1 year renewable for the duration of the course subject to satisfactory progress
C Permanent residence in Australia. Scholarship is available to students entering the first year of any course in the Faculty of Applied Science leading to the award of the degree of Bachelor of Science or Engineering.

Applied Bioscience
Food Science and Technology
Coca-Cola South Pacific Export Corporation
V Up to $1500 pa
T 1 year renewable for the duration of the course subject to satisfactory progress

C Permanent residence in Australia. Not more than 22 years of age on 1 December preceding the year in which the award commences and eligibility for admission to Year 1 of the full-time degree course in Food Technology.

Petroleum Engineering
Society of Petroleum Engineers Pty Ltd
V Up to $2500
C Permanent residence in Australia living in specified state and must have completed the first two years of any accredited engineering program normally in that state

Materials Science and Ceramic Engineering
Materials
Australian Ceramic Society
V Up to $400 pa
T 1 year renewable for the duration of the course subject to satisfactory progress
C Permanent residence in Australia and eligibility for admission to Year 1 or Year 2 of the full-time degree course in Ceramic Engineering

Caroma Industries Ltd
V Up to $1000 pa
T 1 year renewable for the duration of the course subject to satisfactory progress
C Permanent residence in Australia and eligibility for admission to Year 1 of the full-time degree course in Ceramic Engineering

Monler PGH Limited
V Up to $1000 pa
T 1 year renewable for the duration of the course subject to satisfactory progress
C Permanent residence in Australia and eligibility for admission to Year 1 of the full-time degree course in Ceramic Engineering

Clay Brick Association
V Up to $1000 pa
T 1 year renewable for the duration of the course subject to satisfactory progress
C Permanent residence in Australia and eligibility for admission to Year 1 of the full-time degree course in Ceramic Engineering

The Thomson Family
V Up to $2500 pa
T 1 year renewable for the duration of the course subject to satisfactory progress
C Permanent residence in Australia and eligibility for admission to Year 1 of the full-time degree course in Ceramic Engineering

Zacuba Pty Ltd
V Up to $500 pa
T 1 year renewable for the duration of the course subject to satisfactory progress
C Permanent residence in Australia and eligibility for admission to Year 1 of the full-time degree course in Ceramic Engineering

Metallurgy

Sir Rupert Myers
V Up to $2500 pa
T 1 year renewable for the duration of the course subject to satisfactory progress
C Open to students whose parents are permanent residents of Australia or who are themselves permanent residents and who are eligible for admission to Year 1 of the full-time degree course in Metallurgy or Metallurgical Engineering

Comalco Research Award
V Up to $2000
C Eligibility for admission to Year 1 of the full-time degree course in Metallurgy or Metallurgical Process Engineering

Mines

The Charles Warman Scholarship
V $4000 pa
T 1 year renewable subject to satisfactory progress
C Permanent residence in Australia and enrolled in any year of the full-time degree course in Mineral Engineering

Minproc
V $3500 pa
T 1 year renewable for the duration of the course subject to satisfactory progress
C Available to a student entering the degree course Chemical Engineering (Minerals) or who plans to enrol in the combined BE BSc degree course in Chemical and Minerals Engineering

Wool and Animal Science

Merck, Sharp and Dohme
V Up to $500 pa
T 1 year renewable for the duration of the course subject to satisfactory progress
C Eligibility for admission to the full-time degree course in Wool and Pastoral Sciences

Dalgety Farmers Bicentennial
V Up to $2500 pa
T 1 year renewable for the duration of the course subject to satisfactory progress
C Eligibility for admission to the full-time degree course in Wool and Pastoral Sciences

The UNSW Co-op Program

The University of New South Wales has industry-linked education scholarships to the value of $9600 per annum in the following areas: Accounting (and Economics, Finance, Information Systems or Japanese Studies); Business Information Technology, Aerospace, Bioprocess, Ceramic, Chemical, Civil, Electrical, Environmental, Materials, Mechanical, Metallurgical, Mineral, Mining and Petroleum Engineering; Food Science and Technology, Industrial Chemistry, Manufacturing Management, Textile Management, Textile Technology, and Wool and Pastoral Science.
Graduate Scholarships

Listed below is an outline in summary form of Graduate Scholarships available to students. Application forms and further information are available from the Scholarships Unit and Student Centre, located on the Ground Floor of the Chancellery, unless an alternative contact address is provided. Normally applications become available four to six weeks before the closing date.

The following publications may also be of assistance: 1. *Awards for Postgraduate Study in Australia and Awards for Postgraduate Study Overseas,* published by the Graduate Careers Council of Australia. PO Box 28, Parkville, Victoria 3052;* 2. *Study Abroad,* published by UNESCO;*

Details of overseas awards and exchanges administered by the Department of Employment, Education and Training can be obtained from: Awards and Exchanges Section, Department of Employment, Education and Training, PO Box 826, Woden, ACT 2606.

Where possible, the scholarships are listed in order of faculty. Applicants should note that the awards and conditions are subject to review.

*Available for reference in the University Library.

General

**Australian Awards for Research in Asia (AARA)**

- **T** 3 to 12 months
- **C** The awards are for postgraduate study or fieldwork in Cambodia, China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Sri Lanka, Taiwan, Thailand and Vietnam. Applicants must be Australian citizens, or have Permanent Resident status, and have lived in Australia for the 12 months prior to the close of applications on 30 June.

**Caltex National Scholarship for Women**

- **V** $50,000 over two years
- **T** Up to 2 years
- **C** Applicants must be Australian citizens or have resided continuously in Australia for 5 years and have completed, or will complete, in 1994 an award from an Australian institution. Applicants may be proposing to undertake study in any discipline overseas. Application to the Honorary Secretary, Caltex National Scholarship, University by 17 September.

**Kobe Steel Scholarship for Postgraduate Study at St Catherine's College, Oxford University**

- **V** £14,520
- **T** Up to 2 years
- **C** Applicants must be Australian nationals. Applications close on 31 October with Kobe Steel Australia P/L (Level 32 Gateway, 1 Macquarie Place, 2000).

**University Postgraduate Research Scholarships**

- **T** 1-2 years for a Masters and 3-4 years for a PhD degree
- **V** Living allowance of $14,474 pa. Other allowances may also be paid. Tax free.
- **C** Applicants must be honours graduates or equivalent in the Medicine or Commerce faculties, or the University College, Australian Defence Force Academy. A limited number of scholarships are offered subject to the availability of funds. Information should be obtained from the Faculty office.

**Australian Postgraduate Awards**

- **T** 1-2 years for a Masters and 3-4 years for a PhD degree
- **V** $11,687 to $18,679 (1993 rates). Other allowances may also be paid. Tax free.
- **C** Applicants must be honours graduates or equivalent or scholars who will graduate in current academic year, and who are domiciled in Australia. Applications to Registrar by 31 October.

**John Crawford Scholarship Scheme**

- **V** Tuition fees. Some students may be eligible for air fares and a stipend.
- **T** Determined by normal course duration
- **C** Information should be obtained from Australian Diplomatic Posts. Conditions and entitlements vary depending on the home country.

**Overseas Postgraduate Research Scholarships**

- **V** Tuition fees only
- **T** 2 years for a Masters and 3 years for a PhD degree
- **C** Eligibility is confined to postgraduate research students who are citizens of countries other than Australia or New Zealand. Applications to the Registrar by 30 September.

**Australian American Educational Foundation Fulbright Award**

- **V** $11,500 pa and travel expenses
- **T** 1 year, renewable
- **C** Applicants must be graduates who are domiciled in Australia and wish to undertake research or study for a higher degree in America. Applications close 30 September with The Secretary, DEET, AAEF Travel Grants, PO Box 826, Woden, ACT 2606. Application forms are available from the Associate Registrar, University of Sydney, NSW 2006, telephone (02) 692 2222.

**Australian Federation of University Women**

- **V** Amount varies, depending on award
- **T** Up to 1 year
Applicants must be female graduates who are members of the Australian Federation of University Women. Further enquiries may be directed to the Secretary of the Federation, (telephone (02) 232 5629).

Commonwealth Scholarship and Fellowship Plan

V Varies for each country. Generally covers travel, living, tuition fees, books and equipment, approved medical expenses. Marriage allowance may be payable.

T Usually 2 years, sometimes 3

C Applicants must be graduates who are Australian citizens and who are not older than 35 years of age. Tenable in Commonwealth countries other than Australia. Applications close with the Registrar in early October.

The English-Speaking Union (NSW Branch)

V $8000

T 1 year

C Applicants must be residents of NSW or ACT. Awarded to young graduates to further their studies outside Australia. Applications close mid-April with The Secretary, Ground Floor, School of Arts, 275c Pitt Street, Sydney, NSW 2000.

Frank Knox Memorial Stipend of Fellowships

V $US11,500 pa plus tuition fees

T up to 2 years tenable at Harvard University

C Applicants must be British subjects and Australian citizens, who are graduates or near graduates of an Australian university. Applications close with the Academic Registrar mid-October.

Robert Gordon Menzies Scholarship to Harvard

V Up to $US 25,000

T 1 year

C Tenable at Harvard University. Applicants must be Australian citizens and graduates of an Australian tertiary institution. Applications close 31 December with the Registrar, A.N.U., GPO Box 4, Canberra, ACT 2601

Gowrie Scholarship Trust Fund

V $6000 pa. Under special circumstances this may be increased.

T 2 years

C Applicants must be members of the Forces or children of members of the Forces who were on active service during the 1939-45 War. Applications close with the Academic Registrar by 31 October.

Harkness Fellowships of the Commonwealth Fund of New York

V Living and travel allowances, tuition and research expenses, health insurance, book and equipment and other allowances for travel and study in the USA

T 12 to 21 months

C Candidates must be Australian citizens and 1. Either members of the Commonwealth or a State Public Service or semi-government Authority. 2. Either staff or graduate students at an Australian university. 3. Individuals recommended for nomination by the Local Correspondents. The candidate will usually have an honours degree or equivalent, or an outstanding record of achievement, and be not more than 35 years of age. Applications close 30 September with the Academic Registrar. Forms available from Mr J. Larkin, Bureau of Agriculture and Resource Economics, GPO Box 1563, Canberra, ACT 2601.

The Packer, Shell and Barclays Scholarships to Cambridge University

V Living and travel allowances, tuition expenses

T 1-3 years

C Applicants must be Australian citizens who are honours graduates or equivalent, and under 26 years of age. Applications are available from The Secretary, Cambridge Commonwealth Trust, PO Box 252, Cambridge CB2 1T2, England. The scholarship closes on 15 October.

The Rhodes Scholarship to Oxford University

V Approximately $15,000 pa and fees

T 2 years, may be extended for a third year.

C Unmarried Australian citizens aged between 19 and 25 who have anhonours degree or equivalent. Applications close in September each year with The Secretary, University of Sydney, NSW 2006.

Applied Science

Dairy Research and Development Corporation (DRDC) Postgraduate Education Scholarships

V Between $16,000 and $23,000 pa depending on the applicants level of academic achievement

C Applicants must be Australian citizens or Permanent Residents. All applicants must be intending to remain in Australia after completing their studies. Applications close with the DRDC in October. Contact the DRDC (telephone 03 8890577) for more information.

Energy Research and Development Corporation (ERDC) Postgraduate Awards

V $20,000 pa, tax free

T Up to 3 years

C ERDC awards are based on academic excellence or a proven track record of excellence in research which indicates potential to contribute to the energy industry. Contact ERDC Postgraduate Award (06 2744804) for an application. Applications close 30 September.
Meat Research Corporation (MRC) Studentship
V $14,260 for study in Australia or $US17,500 for study overseas. A dependants allowance may be payable.
T Up to 3 years
C Applicants must be Permanent Residents or citizens of Australia. Applicants should be proposing to undertake research in areas of practical value to the Australian beef, sheepmeat, goatmeat and buffalo industries. Applications close 30 September.

Pig Research Council Study/Training Awards
Applications close 1 December with the Pig Research and Development Corporation, PO Box 4804, Kingston, ACT 2604 (telephone: 062725139)

Rural Industries Research and Development Corporation (RIRDC) Postgraduate Scholarships
V $21,000 pa plus allowances
T Up to 3 years
C Applicants must be Australian citizens or Permanent Residents. Applications close 6 November with the RIRDC, PO Box 4776, Kingston ACT 2604.

Sir Robert Gordon Menzies Memorial Scholarship In Earth Sciences for Study in the United Kingdom
V £15,000 pa, tax free. Air fare and additional allowances may be payable.
T Up to 3 years
C Applicants should be aged between 21 and 35 and be Australian citizens with at least 5 years standing as residents. Applications are available from the Scholarships Unit. Applications close on 30 June with Sir Robert Gordon Menzies Foundation, “Clarendon Terrace”, 210 Clarendon St, East Melbourne, Vic 3002.

Sugar Research and Development Corporation (SRDC) Postgraduate Scholarships
• Applications and information are available from the SRDC, PO Box 12050, Brisbane, Elizabeth St, Q4002, Australia. Applications close 30 September.

Wool Research and Development Corporation (WRDC) Postgraduate Scholarships
V $21,362 pa (taxable)
T Up to 4 years subject to satisfactory progress
C Tenable in Australian tertiary institutions or overseas in exceptional circumstances. Enquiries to the School of Fibre Science and Technology. Applications close early September with the WRDC, GPO Box 5343BB, Melbourne Vic 3001 (telephone: 03 3419184)

Land and Water Resources Research and Development Corporation (LWRRDC)
V $20,000 pa
T 2-4 years
C Applications close with the LWRRDC on 30 July.

Prizes

Undergraduate University Prizes
The following information summarizes undergraduate prizes awarded by the University. Prizes which are not specific to any School are listed under General. All other prizes are listed under the Faculty or Schools in which they are awarded.

Information regarding the establishment of new prizes may be obtained from the Examinations Section located on the Ground Floor of the Chancellery.

General

The Sydney Technical College Union Award
V $400.00 and Bronze Medal
C Leadership in student affairs combined with marked academic proficiency by a graduand

The University of New South Wales Alumni
V Statuette Association Prize
C Achievement for community benefit by a student in the final or graduating year

School of Applied Bioscience

Food Science and Technology

The Cottee’s Foods Prize
V $500.00
C The best performance in FOOD1420 Food Legislation in the Bachelor of Science in Food Technology degree course
The Nestlé Australia Pty Limited Prize
V $200.00
C The best performance in FOOD1400 Project in the Bachelor of Science in Food Science and Technology degree course

The Wilfred B.S. Bishop Prize
V $75.00
C The best overall performance in the Bachelor of Science Degree in Food Science and Technology degree course by a student who has made a significant contribution to staff and student activities

Biotechnology

The Amersham Modern Techniques in Biotechnology Prize
V $250.00
C The best performance in BIOT3061 Monoclonal Antibody and Genetic Techniques in Biotechnology

The Burns Philip Food Prize
V $175.00
C The best performance in BIOT3100 Fermentation Processes in the Bachelor of Science degree course

The Burns Philip Food Prize
V $175.00
C The best performance in one of the Level 3 Biotechnology subjects
• BIOT3011 Biotechnology A
• BIOT3021 Biotechnology B
• BIOT3031 Microbial Genetics
• BIOT3061 Monoclonal Antibody and Genetic Techniques in Biotechnology
by a student in the Bachelor of Science degree course

The Burns Philip Food Prize
V $175.00
C The best overall performance in the Bachelor of Science degree course in Biotechnology at honours level

School of Chemical Engineering and Industrial Chemistry

The Abbott Laboratories Pty Ltd Prize
V $200.00
C The best performance in Year 4 of the Bachelor of Engineering degree course in Chemical Engineering.

The AKZO Chemicals Prize
V $500.00
C The best performance in INDC3090 Chemistry of Industrial Processes

The Australasian Corrosion Association (NSW Branch) Award
V $150.00 and one years membership of the Association
C The best performance in INDC3042 Corrosion in the Chemical Industry

The Australian Institute of Energy Prize
V $50.00
C The best performance in a subject selected by the Head of School

The Australian Paper Manufacturers Ltd Prize
V $200.00
C The best performance in CHEN3070 Instrumentation and Process Control 1 in the Chemical Engineering course

The Australian Paper Manufacturers Ltd Prize
V $200.00
C The best performance in CHEN3070 Instrumentation and Process Control 1 in the Industrial Chemistry course

The CSR Limited Prize
V $100.00
C The best performance in a subject selected by the Head of School

The Fuel Technology Staff Prize
V $200.00
C The best performance in a subject selected by the Head of School

The Johnson Matthey Prize
V $200.00
C The best performance in the Industrial Chemistry degree course

The National Starch & Chemical Prize
V $500.00
C The best performance in POLY3010 Polymer Science

The Shell Prize
V $100.00
C The best performance by a student in Year 2 or equivalent part-time stage of the Chemical Engineering
or Industrial Chemistry courses including sporting and student activities

The Shell Prize
V $100.00
C The best performance by a student in Year 3 or equivalent part-time stage of the Chemical Engineering or Industrial Chemistry courses including sporting and student activities

The Shell Prize
V $100.00
C The best performance by a student in Year 4 or equivalent part-time stage of the Chemical Engineering or Industrial Chemistry courses including sporting and student activities

The Shell Prize
V $100.00
C For a student who has, in the opinion of the Head of School, performed some meritorious activity of note either inside or outside the University

The Shell Prize
V $200.00
C The best performance in a subject selected by the Head of School

The Simon-Carves Australia Prize
V $100.00
C The best performance in CHEN3010 or INDC3010 Thermodynamics

The Western Mining Corporation Ltd Prize
V $150.00
C The best performance in CHEN2050 Chemical Engineering Laboratory 1

The Western Mining Corporation Ltd Prize
V $150.00
C The best performance in CHEN3080 Chemical Engineering Laboratory 2

School of Fibre Science and Technology
Textile Technology

The J.B. Speakman Prize
V $50.00
C The best undergraduate thesis in the final year of the Bachelor of Science degree course in Textile Technology or Textile Management

The R.J. Webster Prize
V $250.00
C The best performance throughout the Bachelor of Science degree course in Textile Technology or Textile Management

The Textile Institute Prize
V Two years free membership of the Textile Institute
C The best performance in textile technology subjects by a student in the Bachelor of Science degree course in Textile Technology or Textile Management

Wool and Animal Science

The Bayer Animal Health Prize
V $120.00
C The best performance in Years 2 and Year 3 of a degree course in Wool and Pastoral Science

The C.R. Luckock Prize
V Book or $60.00 voucher drawn on University Co-op Bookshop
C The best performance in Meat Science in the Department of Wool and Animal Sciences

The National Farmers' Federation Prize
V $150.00
C Excellent academic attainment by a graduating student in the Bachelor of Science degree course in Wool and Pastoral Sciences

The Parkes Wool Promotion Committee Prize
V A shield held in the Department of Wool and Animal Science on which the name of the successful student is engraved each year
C The best performance in Practical Wool Studies in the Department of Wool and Animal Sciences

The P.P. McMahon Memorial Prize
V $100.00
C Excellence in Wool Science in the Bachelor of Science degree course in Wool and Pastoral Sciences

School of Geography

The Jack Mabbutt Medal
V Medal
The best performance in the Year 4 Project in Applied Geography by a student in the Bachelor of Science degree course in Applied Science

The Jack Mabbutt Prize
V $150.00
C Best performance by a Year 3 student proceeding to the award of honours in Geography

School of Materials Science and Engineering

The ACI Glass Packaging Prize
V $200.00
C Outstanding quality in an honours thesis in one of the areas of glass or glass-ceramics in the Bachelor of Engineering in Ceramic Engineering course

The ANSTO Prize
V $100.00
C The best performance in year four in the Bachelor of Engineering in Ceramic Engineering course

The Alcan Australia Ltd Prize
V $200.00
C The best performance in a subject selected by the Head of School

The Austral Bricks Prize
V $100.00
C The best performance in year three in the Bachelor of Engineering in Ceramic Engineering course

The Australasian Corrosion Association (NSW)
V $150.00
C The best performance in MATS1203 Materials & Design 2 by a student in the Bachelor of Metallurgical Engineering degree course

The Australasian Ceramic Society Prize
V $100.00
C The highest overall course aggregate by a student completing the final year of the Bachelor of Engineering degree course in Ceramic Engineering

The Boral Bricks Prize
V $500.00
C The best performance in MATS2173 Chemistry of Ceramic Processing, Unit 2, Technical and Non-Technical Ceramics in the Bachelor of Engineering in Ceramic Engineering course

The Broken Hill Proprietory Company Prize
V $1,000.00
C The best performance in Metallurgical Engineering course by a graduating student

The Caroma Industries Limited Prize
V $400.00
C The best performance in MATS1464 Materials Seminar and MATS2304 Project (Ceramic Engineering) (with each subject receiving one half of the weighting for the average) in the Bachelor of Engineering in Ceramic Engineering course

The Commercial Minerals Limited Prize
V $200.00
C The best performance in MATS2133 Ceramic Raw Materials in the Bachelor of Engineering in Ceramic Engineering course

The Cookson Plimbrico Prize
V $350.00
C The best performance in MATS2173 Chemistry of Ceramic Processing, Unit 1, Refractories in the Bachelor of Engineering in Ceramic Engineering course

The Ferro Corporation (Australia) Prize
V $250.00
C The best performance in MATS2123 Ceramic Process Principles 2 in the Bachelor of Engineering in Ceramic Engineering course

The Hugh Muir Prize
V $275.00
C The best performance by a student in the final year seminar class, or who in the opinion of the Head of School has contributed most to the corporate life of the School of Materials Science and Engineering.

The ICI Advanced Ceramics Prize
V $100.00
C The best overall academic performance by a student in the second year of the Bachelor of Engineering in Ceramic Engineering course

The Institute of Metals and Materials Australasia Prize
V $200.00 and one years membership of the Institute
C The best performance in a subject selected by the Head of School

The Laporte Minerals Prize
V $250.00
C The most aptitude and technique shown in the combined laboratory subjects MATS2153 Ceramic
Processing Laboratory and MATS2203 Physico-Chemical Ceramics Laboratory with each subject receiving one half of the weighting for the average, by a student in the Bachelor of Engineering in Ceramic Engineering course

The Max Hatherly Prize
V $275.00
C The best performance in the final year practical examination or for an outstanding performance in Metallography

The Monier PGH Prize
V $1,000.00
C The best performance by a graduating student in the Bachelor of Engineering in Ceramic Engineering course

The Morganite Ceramic Fibres Pty Ltd Prize
V $200.00
C The best performance in MATS2254 Ceramic Engineering Design by a student in the Bachelor of Engineering in Ceramic Engineering course.

The Sialon Ceramics Prize
V $100.00
C The best performance in an honours thesis that reflects an advancement in the technology and development of advanced ceramics by a student proceeding to the degree of Bachelor of Engineering in Ceramic Engineering

The Taylor Ceramic Engineering Prize
V $100.00 & plaque
C The greatest overall amount of ingenuity shown in professional activities by a graduating student in the Bachelor of Engineering in Ceramic Engineering course

The Wallarah Minerals Prize
V $100.00
C The best performance in an honours thesis by a student in the Bachelor of Engineering degree course in Ceramic Engineering

The Welding Technology Institute of Australia Prize
V Books to the value of $200.00 + 1 years Membership of the Institute
C The best performance in MATS4384 Welding Science and Technology

The Western Mining Corporation Ltd Prize
V $150.00
C The best overall performance in Year 4 full-time (or its part-time equivalent) in the Bachelor of Metallurgical Engineering in Process Metallurgy or Bachelor of Science (Technology) degree courses in Metallurgy

School of Mines

The Western Mining Corporation Ltd Melbourne Prize
V $200.00
C The best overall performance by a student in the Bachelor of Engineering degree course in Mining Engineering

The Western Mining Corporation Ltd Perth Prize
V $150.00
C The best overall performance by a student in the final year of the Bachelor of Engineering degree course in Mining Engineering

Applied Geology

The Crae Mapping Prize in Applied Geology
V $250.00
C The best performance in GEOL3121 Earth Environments 2 - Geological Field Mapping Tutorial by a student in the Bachelor of Science degree course

The F.C. Loughnan Prize For First Year Geology
V $150.00
C The best performance in year 1 of the Geology component of the Bachelor of Science degree course

The F.C. Loughnan Prize in Applied Geology
V $150.00
C The best performance in Year 3 of the Geology component of the Bachelor of Science degree course
The Lorant Eötvös Prize in Geology
V $300.00 & Medal
C The best performance in GEOL4111 Advanced Geological Techniques by a final year student in the Bachelor of Science in Applied Geology course or Bachelor of Science with Honours in Applied Geology course

The Prospectors Supplies Prize
V Brunton Compass
C Meritorious performance in GEOL4203 Field Project by a student in Year 4 of the Applied Geology degree course, or equivalent Science and Mathematics degree course at honours level, proceeding to the award of the degree of Bachelor of Science

Graduate University Prizes

Faculty of Commerce and Economics

The Universities Credit Union Prize
V $200.00
C The best performance by a full-time student in Year 1 of the Master of Commerce degree course

The Universities Credit Union Prize
V $200.00
C The best performance by a part-time student in Year 1 of the Master of Commerce degree course

Faculty of Applied Science

Safety Science

The Ergonomics Society of Australia (NSW) Prize
V $100 and membership of the Society
C The best performance in the core subjects of the Graduate Diploma course in Ergonomics

The Manufacturers Mutual Insurance Prize for Ergonomic Principles
V $200.00
C The best performance in SAFE9224 Principles of Ergonomics by a student proceeding either to the award of the degree of Master of Safety Science or to the Graduate Diploma in Safety Science or to the Graduate Diploma in Ergonomics

The Manufacturers Mutual Insurance Prize for Occupational Disease
V $150.00
C The best performance in CMED9701 Occupational Disease by a student proceeding either to the award of the degree of Master of Safety Science or to the Graduate Diploma in Safety Science or to the Graduate Diploma in Ergonomics

The Manufacturers Mutual Insurance Prize for Occupational Health and Hygiene
V $150.00
C The best performance in CMED9701 Occupational Disease by a student proceeding either to the award of the degree of Master of Safety Science or to the Graduate Diploma in Safety Science or to the Graduate Diploma in Ergonomics

The National Safety Council of Australia (NSW Division) Prize
V $100.00
C The best performance in SAFE9211 Introduction to Safety Engineering in the Masters degree or Graduate Diploma courses in Safety Science

The National Starch and Chemical Prize
V $200.00
C The best performance in SAFE9543 Management of Dangerous Materials by a student enrolled in a Diploma or Coursework Masters degree in the Department of Safety Science

The Neil Adams Ergonomics Prize
V $250.00
C Awarded annually to the student enrolled in the Graduate Diploma course in Ergonomics who achieved the best performance in the preceding calendar year considering the students best three subjects during that year, providing at least one of the three subjects was an Ergonomics subject
The Safety Institute of Australia (NSW Division)
Bill Lessels' Memorial Prize for Master of Safety Science
V Books to the value of $200.00
C The best overall performance by a student in the Master of Safety Science degree course

The Safety Institute of Australia (NSW Division)
Bill Lessels' Memorial Prize for Graduate Diploma in Safety Science
V Books to the value of $200.00
C The best overall performance by a student in the Graduate Diploma course in Safety Science

The Whiteley Chemicals Prize
V $200.00
C The best performance in SAFE9263 Chemical Safety and Toxicology by a student in the Diploma or Coursework Masters course in the Department of Safety Science

School of Applied Bioscience
Biotechnology
The Burns Philip Foods Prize
V $175.00
C The best overall performance in the Master of Applied Science degree course in Biotechnology

Food Science and Technology
The Spruson & Ferguson Patent & Trade Mark Prize
V $250.00
C The best performance in the Seminar presentation by a student proceeding to the degrees of Master of Science or Doctor of Philosophy in the Department of Food Science and Technology

School of Chemical Engineering and Industrial Chemistry
The Clean Air Society of Australia and New Zealand Prize in Atmospheric Pollution Control
V $100.00
C The highest aggregate in FUEL5910 Atmospheric Pollution and Control and FUEL5920 Practical Aspects of Air Pollution Measurement and Control in a graduate course in the School of Chemical Engineering and Industrial Chemistry

School of Fibre Science and Technology
Textile Technology
The Malcolm Chaikin Prize
V $200.00 and Bronze Medal
C The most outstanding PhD thesis in the Department of Textile Technology

School of Mines
Applied Geology
The Laric V. Hawkins Prize
V $500.00
C The best written account of research work in the area of Geophysics in a graduate degree or diploma course
The University of New South Wales, Kensington Campus

Theatres
Biomedical Theatres E27
Central Lecture Block E19
Chemistry Theatres (Dwyer, Mellor, Murphy, Nyholm, Smith) E12
Classroom Block (Western Grounds) H3
Fig Tree Theatre B14
Io Myers Studio D9
Keith Burrows Theatre J14
Mathews Theatres D23
Parade Theatre E3
Quad Theatre E15
Macauley Theatre (Main Building) K14
Rex Vowels Theatre F17
Macauley Theatre
Parade Theatre E3
Mathews Theatres D23
Keith Burrows Theatre J14
lo Myers Studio D9
Biomedical Theatres E27
Central Lecture Block El... King St, Randwick
WHO Regional Training Centre 027
Wool and Animal Sciences G14
Works and Maintenance B14A

Buildings
Applied Science F10
Barker Street Gatehouse N11
Basser College (Kensington) C18
Central Store B13
Chancellery C22
Dalton (Chemistry) F12
Goldstein College (Kensington) D16
Golf House A27
Gymnasium B5
International House C6
John Goodsell (Commerce and Economics) F20
Kensington Colleges (Office) C17
Library (University) E21
Link B6
Maintenance Workshop B13
Mathews F23
Menzies Library E21
Morven Brown (Arts) C20
New College L6
Newton J12
NIDA D2
Parking Station H25
Parking Station N18
Philip Baxter College (Kensington) D14
Quadrangle E15
Robert Heflon (Chemistry) E12
Sam Cracknell Pavilion H8
Samuels Building F26
Shalom College N9
Sir Robert Webster G14
Unisearch House LS
University Regiment J2
University Union (Roundhouse) E6
University Union (Blockhouse) G6
University Union (Squarehouse) E4
Wallace Wurth School of Medicine C27
Warrane College M7
Communications Law Centre C15
Community Medicine D26
Computer Science and Engineering G17
Computing Services Department F25
Cornea and Contact Lens Research Unit: 22-32 King St, Randwick
Economics F20
Education Studies G2
Educational Testing Centre E4
Electrical Engineering G17
Energy Research, Development & Information Centre F10
Engineering (Faculty Office) K17
English C20
Examinations C22
Fees Office C22
Fibre Science and Technology G14
Food Science and Technology B8
French C20
Geography K17
German and Russian Studies C20
Graduate School of the Built Environment H14
Groundwater Management and Hydrogeology F14
Health Services, University E15
Health Services Management C22
History C20
House at Pooh Corner (Child Care) N8
Human Resources C22
Industrial Design G14
Industrial Relations and Organizational Behaviour F20
Information, Library & Archives Studies F23
Information Systems E15
Institute of Languages: 4 Francis St, Randwick
International Student Centre F9
IPACE Institute F23
Japanese Economic and Management Studies E15
Kanga's House (Child Care) O14
Landscaping Architecture K15
Law (Faculty Office) F21
Law Library F21
Legal Studies & Taxation F20
Liberal and General Studies C20
Lost Property C22
Marine Science C26
Marketing F20
Materials Science and Engineering E8
Mathematics F23
Mechanical and Manufacturing Engineering J17
Medical Education C27
Medicine (Faculty Office) B27
Membrane and Separation Technology F10
Microbiology and Immunology D26
Mines K15
Music and Music Education B11
News Service C22
Optometry J12
Pathology C27
Performing Arts B10
Petroleum Engineering D12
Philosophy C20
Physics K15
Physiology and Pharmacology C27
Political Science C20
Printing Section C22
Professional Development Centre E15
Professional Studies (Faculty Office) G2
Property C22
Psychology F23
Publications Section C22
Remote Sensing K17
Safety Science B8
Science (Faculty Office) E12
Science and Technology Studies C20
Social Science and Policy C20
Social Policy Research Centre F25
Social Work G2
Sociology C20
Spanish and Latin American Studies C20
Sport and Recreation Centre B6
Squash Courts B7
Student Centre (off Library Lawn) C22
Student Services: Careers, Loans, Accommodation etc E15
Counselling E15
Students' Guild E15
Students' Union E15
Surveying K17
Swimming Pool B4
Textile Technology G14
Theatre and Film Studies B10
Town Planning K15
UNSW Press: 22-32 King St, Randwick
WHO Regional Training Centre C27
Wool and Animal Sciences G14
Works and Maintenance B14A
This Handbook has been specifically designed as a source of detailed reference information for first year and re-enrolling undergraduate and postgraduate students. Separate handbooks are published for Applied Science, Arts and Social Sciences, Built Environment, Commerce and Economics, Engineering, Law, Medicine, Professional Studies, Science, the Australian Graduate School of Management, College of Fine Arts, University College (ADFA) and the Centre for Liberal and General Studies. For fuller details about the University – its organisation, staff members, description of disciplines, scholarships and prizes and so on, consult the University Calendar (Summary Volume). For further information on student matters consult the University Student Guide.