378-94405 NEW 90

# THE UNIVERSITY OF NEW SOUTH WALES



# Faculty of Applied Science HANDBOOK 1997

# THE UNIVERSITY OF NEW SOUTH WALES



# Faculty of Applied Science HANDBOOK 1997

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 1996, but may be amended without notice by the University Council.

# **CREDIT POINTS – IMPORTANT NOTE**

From 1996, UNSW introduced a university wide credit point system for all subjects offered to both undergraduate and postgraduate students. The system means that a subject will have the same credit point value irrespective of which faculty's course it is counting towards. Students are able to determine the value of subjects taken from other faculties when planning their programs of study. The student load for a subject is calculated by dividing the credit point value of a subject by the total credit points required for the program for that year of the course. Student load is used to determine both HECS and overseas student fees. Students who take more than the standard load for that year of a course will pay more HECS.

Old subject measures have been replaced by new university credit points. Every effort has been made to ensure the accuracy of the credit point values shown for all subjects. However, if any inconsistencies between old and new credit point measures cause concern, students are advised to check with their faculty office for clarification before making 1997 subject selections based on the credit points shown in this handbook.

© The University of New South Wales

The address of the University of New South Wales is:

The University of New South Wales SYDNEY 2052 AUSTRALIA

Telephone: (02) 9385 1000 Facsimile: (02) 9385 2000 Email: Records.Admin@unsw.edu.au Telegraph: UNITECH, SYDNEY Telex: AA26054 http://www.unsw.edu.au

Designed and published by the Publications Section, Administrative Services Department, The University of New South Wales

Printed by PLT Print Solutions

# Contents

| Introduction  | 1            |
|---|--------------|
| Calendar of Dates   | 3            |
| Staff   | 5            |
| Handbook Guide  | 11           |
| Faculty Information   | 15           |
| Some People Who Can Help You  | 15           |
| Enrolment Procedures  | 15           |
| Students With Disabilities  | 15           |
| Equal Opportunity in Education Policy Statement                             |              |
| Student Clubs and Societies   |              |
| Applied Sciences Library Facilities   |              |
| Computing Requirements  |              |
| Computing at UNSW   | aineerina 17 |
| Conditions for the Award of the Degree of Bachelor of Science (Technology)  | ginooning    |
| or Bachelor of Science (Engineering)  | 17           |
| General Education Program   | 17           |
| Undergraduate Study: Summary of Courses                                     | 19           |
| Graduate Study: Summary of Courses  | 21           |
| School of Applied Bioscience  | 33           |
| Department of Biotechnology   |              |
| Undergraduate Study   |              |
| 3052 Biotechnology – Full-time Course                                       |              |
| 3055 Bioprocess Engineering – Full-time Course                              |              |
| Graduate Study  |              |
| Master of Applied Science Degree Courses                                    |              |
| 8042 Master of Applied Science (Biotechnology)                              |              |
| 8043.1000 Master of Applied Science (Biopharmaceuticals)                    | ation 38     |
| 8043.2000 Master of Applied Science (Biopharmaceuticals) - Distance Educate |              |
| Department of Food Science and Technology                                   |              |
| Undergraduate Study   |              |
| 3060 Food Science and Technology – Full-time Course                         | 41           |
| 3065 Honours in Food Science – Full-time Course                             | 42           |
| 3070 Food Science and Technology – Part-time Course                         | 42           |
| Graduate Study  | 43           |

| Master of Applied Science Degree Courses       | 43 |
|--|----|
| 8032.1000 Food Technology                      | 44 |
| 8032.2000 Food Microbiology                    | 44 |
| 8032.3000 Food Engineering                     | 45 |
| 8032.4000 Food Science and Nutrition           | 45 |
| 5020 Food Technology Graduate Diploma Course 4 | 45 |
| Subject Descriptions                           | 16 |

| School of Chemical Engineering and Industrial Chemistry | 57 |
|---|----|
| Undergraduate Study                                     |    |
| 3040 Chemical Engineering - Full-time Course            |    |
| 3050 Chemical Engineering - Part-time Course            |    |
| 3100 Industrial Chemistry – Full-time Course            |    |
| 3110 Industrial Chemistry – Part-time Course            |    |
| Graduate Study  |    |
| Master of Applied Science Degree Courses                |    |
| 8016 Process Engineering                                |    |
| 8060 Fuel Technology                                    |    |
| Subject Descriptions                                    |    |

| School of Fibre Science and Technology             | 77 |
|--|----|
| Department of Textile Technology                   | 78 |
| Undergraduate Study                                |    |
| 3170 Textile Technology - Full-time Course         |    |
| 3175 Textile Management - Full-time Course         |    |
| Graduate Study                                     |    |
| 5090 Textile Technology Graduate Diploma Course    |    |
| Department of Wool and Animal Science              |    |
| Undergraduate Study                                |    |
| 3220 Wool and Pastoral Sciences - Full-time Course |    |
| Graduate Study                                     |    |
| Graduate Program in Wool and Pastoral Sciences     |    |
| 5081 Wool and Pastoral Sciences                    |    |
| Graduate Programs in Rangeland Management          |    |
| 8025 Rangeland Management                          |    |
| 5025 Rangeland Management                          |    |
| Subject Descriptions                               |    |
|  |    |

| School of Geography                                | 93   |
|--|------|
| Undergraduate Study                                | . 94 |
| Applied Geography - Full-time Courses              | .94  |
| 3010.1000 Applied Physical Geography               | . 94 |
| 3010.2000 Applied Economic Geography               | . 95 |
| 3010.3000 Human and Physical Resources – Physical  | . 96 |
| 3010.4000 Human and Physical Resources – Economic  | . 97 |
| Graduate Study                                     | 98   |
| Graduate Program in Geographic Information Systems | . 98 |
| 8047.1000 Geographic Information Systems           | 98   |
| Graduate Programs in Rangeland Management          | . 99 |
| Graduate Programs in Remote Sensing                | 99   |
| 8047.2000 Remote Sensing                           | 99   |
| 5047.2000 Remote Sensing                           | 99   |
| Graduate Programs in Environmental Studies1        | 100  |
| 8045 Environmental Studies                         | 100  |
| 8047.3000 Environmental Management                 | 100  |
| Subject Descriptions                               | 00   |
|  |      |

| School of Materials Science and Engineering | 109 |
|---|-----|
| Ceramic Engineering and Ceramics            |     |
| Metallurgical Engineering                   |     |
| Materials Engineering                       |     |
| Undergraduate Study                         |     |

| Ceramic Engineering and Ceramics                  |     |
|---|-----|
| 3025 Ceramic Engineering - Full-time Course       |     |
| 3030 Ceramic Engineering - Part-time Course       | 112 |
| Metallurgical Engineering                         | 113 |
| 3125 Metallurgical Engineering - Full-time Course | 113 |
| Metallurgy - Part-time Course                     | 114 |
| Materials Engineering                             | 115 |
| 3615 Materials Engineering – Full-time Course     | 115 |
| Graduate Study                                    | 117 |
| 8065 Engineering Materials                        |     |
| 8052 Corrosion Engineering                        | 117 |
| Subject Descriptions                              | 118 |
|   |     |

| School of Mines   | 127 |
|---|-----|
| Department of Applied Geology   | 128 |
| Undergraduate Study   | 128 |
| 3000 Applied Geology - Full-time  | 128 |
| 3000 Applied Geology - Part-time  | 129 |
| Graduate Study  | 130 |
| 8022 Applied Geology  | 130 |
| 8022 1000 Engineering Geology/Hydrogeology/Environmental Geology                          | 130 |
| SO22 2000 Groundwater Studies   | 130 |
| Sol22 3000 Geological Data Processing   | 131 |
| 1000 Doctor of Philosophy (PhD) and 2000 Master of Science (MSc)                          | 131 |
| Department of Mining Engineering  | 132 |
| Department of mining Englished by   | 132 |
| 3140 Bachelor of Engineering BE   | 132 |
| 3146 BE(Civil) BE(Mining) in Civil Engineering and Mining Engineering – Full-time Course. | 133 |
| Graduate Study  | 134 |
| 8055 Mining and Mineral Engineering Graduate Course                                       | 134 |
| 5040 Mining and Mineral Engineering Graduate Dinloma Course                               | 135 |
| Key Centre for Mines  | 136 |
| Reg dente to minice   | 136 |
| 8057 Master of Mining Management MMinMgmt   | 136 |
| Subject Descriptions  | 137 |
|   |     |

| Centre for | Petroleum | Engineering |
|------------|-----------|-------------|
|------------|-----------|-------------|

| Centre for Petroleum Engineering                   | 157 |
|--|-----|
| Undergraduate Study                                | 158 |
| 3045 Petroleum Engineering – Full-time Course      | 158 |
| Graduate Study                                     | 159 |
| 5031 Petroleum Engineering Graduate Diploma Course | 159 |
| Subject Descriptions                               | 159 |

| Department of Safety Science 16<br>Graduate Study 16            | i3<br>54 |
|---|----------|
| 8044 Master of Applied Science (Occupational Health and Safety) | 34       |
| 8075 Master of Applied Science (Ergonomics)                     | 35<br>20 |
| 8077 Master of Applied Science (Industrial Safety)              | 56       |
| Graduate Diploma Courses  | 57       |
| 5480 Graduate Diploma in Safety Science 16                      | 37       |
| 5485 Graduate Diploma in Ergonomics                             | 37<br>50 |
| 7340 Graduate Certificate in Safety Science                     | 58       |
| 8045 Master of Environmental Studies                            | 58       |
| 5488 Graduate Diploma in Environmental Studies                  | 70       |
| Subject Descriptions 17   | 70       |

| Centres in the Faculty of Applied Science | 175 |
|---|-----|
| Bioengineering Centre                     | 176 |
| Centre for Applied Polymer Science        | 176 |
| Centre for Minerals Engineering           | 176 |

| Centre for Particle and Catalyst Technologies                | 176 |
|--|-----|
| Centre for Remote Sensing and Geographic Information Systems | 177 |
| Energy Research, Development and Information Centre (ERDIC)  | 177 |
| Key Centre for Mines   | 178 |
| UNESCO Centre for Membrane Science and Technology            | 178 |
| UNSW Groundwater Centre                                      | 178 |
| The Australian Petroleum Cooperative Research Centre         | 179 |
| CRC for Biopharmaceuticals                                   | 179 |
| CRC for Black Coal Utilisation                               | 179 |
| CRC for Food Industry Innovation                             | 179 |
| CRC for Premium Quality Wool                                 | 180 |
|  |     |

# Servicing Subject Descriptions

| 101 |
|-----|
|-----|

| Scholarships   | 227   |
|--|-------|
| Undergraduate Scholarships   | . 228 |
| Scholarships for students entering the first year of an undergraduate course | . 228 |
| Scholarships for students in their second or later year of study             | . 230 |
| Honours Year Scholarships  | . 233 |
| Travel Scholarships  | . 235 |
| Graduate Scholarships  | . 237 |
| General Scholarships   | . 237 |
| Faculty of Applied Science   | . 242 |
| General Travel Scholarships  | . 243 |

| Prizes               | 249   |
|----------------------|-------|
| Undergraduate Prizes | . 249 |
| Graduate Prizes      | . 256 |

# Introduction

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. The Faculty of Applied Science also has a number of specialised research and teaching centres including Commonwealth Cooperative Research Centres, Key Centres and a UNESCO Centre.

Undergraduate courses available are:

- Applied Geology (including specialisation 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. Students should discuss their programs with appropriate staff to ensure that their chosen course of study is appropriate to their aims and aspirations.

The importance of applied science to the University of New South Wales, and to the wider community, is fully recognised and is especially referred to in the University Act of Incorporation. The Faculty of Applied Science is dynamic, with changing activities and programs 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 program 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.

GJS Govett Dean Faculty of Applied Science 2 APPLIED SCIENCE

# Calendar of Dates

The academic year is divided into two sessions, each containing 14 weeks for teaching. Between the two sessions there is a break of approximately six weeks, which includes a one-week study period, two weeks for examinations, and three weeks recess. There is also a short recess of one week within each session.

Session 1 commences on the Monday nearest 1 March.

#### Faculties other than Medicine, AGSM and University College

|                    | 1997   | 1998   |
|--------------------|--|--|
| Session 1          |  |  |
| (14 weeks)         | 3 March to 27 March<br>7 April to 13 June          | 2 March to 9 April<br>20 April to 12 June          |
| Mid-session recess | 28 March to 6 April                                | 10 April to 19 April                               |
| Study period       | 14 June to 19 June                                 | 13 June to 18 June                                 |
| Examinations       | 20 June to 8 July                                  | 19 June to 7 July                                  |
| Mid-year recess    | 9 July to 27 July                                  | 8 July to 26 July                                  |
| Session 2          |  |  |
| (14 weeks)         | 28 July to 26 September<br>7 October to 7 November | 27 July to 25 September<br>6 October to 6 November |
| Mid-session recess | 27 September to 6 October                          | 26 September to 5 October                          |
| Study period       | 8 November to 13 November                          | 7 November to 12 November                          |
| Examinations       | 14 November to 2 December                          | 13 November to 1 December                          |

# Important dates for 1997

#### January 1997

- New Year's Day Public Holiday W 1
- M 13 Medicine IV – Term 1 begins
- Th 16 M 27 Medicine V - Term 1 begins
- Australia Day Public Holiday
- т 28 Enrolment period begins for new undergraduate students and undergraduate students repeating first year
- AGSM EMBA Executive Year Session 1 begins W 29

#### February 1997

- M 10 AGSM EMBA GMQ and GDM programs -Session 1 begins
- AGSM MBA program Year 1 classes Term 1 begins Medicine VI Term 2 begins M 24

#### March 1997

- Μ 3 Session 1 begins - for Faculties other than Medicine and AGSM University College, ADFA - Session 1 begins AGSM MBA program - Year 2 classes -Term 1 begins
- Last day applications are accepted from students F 14 to enrol in Session 1 or whole year subjects
- Su 16 Medicine IV - Term 1 ends
- Medicine IV Term 2 begins M 17
- Medicine V Term 1 ends Su 23
- F 28 Good Friday - Public Holiday Mid-session recess begins - for Faculties other than Medicine, AGSM and University College, ADFA
- Easter Saturday S 29
- Su 30 Easter Sunday
- M 31 Last day for students to discontinue without failure subjects which extend over Session 1 only.

HECS Census Date for Session 1 Easter Monday - Public Holiday

#### April 1997

- Medicine V Term 2 begins 1
- Mid-session recess ends for Faculties other than Medicine, AGSM and University College, ADFA Su. 6
- Su 13
- M 14
- Medicine VI Term 2 ends Medicine VI Recess begins Medicine VI Recess ends Medicine VI Term 3 begins Su 20
- M 21
- Anzac Day Public Holiday Medicine IV Term 2 ends F 25
- Su 27 Medicine IV – Recess begins M 28

#### May 1997

- s 3 University College, ADFA - May recess begins
- Medicine IV Recess ends Medicine IV Term 3 begins Šц ã.
- 5 М
- AGSM MBA program all classes Term 1 ends AGSM MBA program all classes -F 9 м
- 12 Examinations begin
- т 13 Publication of provisional timetable for June examinations
- F 16 AGSM MBA program - all classes - Examinations end
- Su 18
- University College, ADFA May recess ends Last day for students to advise of examination clashes ŵ 21 s 24 AGSM ÉMBA GMQ and GDM programs – Session 1 ends AGSM EMBA GMQ and GDM programs -
- Examination т 27 AGSM EMBA Executive Year - Session 1 ends

#### June 1997

- Medicine V Term 2 ends Su 1
- Medicine VI Term 3 ends
- Μ 2 AGSM MBA program – all classes – Term 2 begins Medicine VI – Term 4 begins
- т 3 Publication of timetable for June examinations
- М a Queen's Birthday - Public Holiday Medicine V - Term 3 begins т 10
- Ė
- Session 1 ends for Faculties other than Medicine, AGSM and University College, ADFA 13
- Study period begins for Faculties other than Medicine, AGSM and University College, ADFA Medicine IV Term 3 ends S 14
- Su 15 M 16
- Medicine IV Term 4 begins Study period ends for Faculties other than Th 19
- Medicine, AGSM and University College, ADFA Examinations begin - for Faculties other than F 20
- Medicine, AGSM and University College, ADFA University College, ADFA – Session 1 ends University College, ADFA – Examinations begin M 23
- AGSM EMBA Executive Year Session 2 begins

#### July 1997

- 5
- University College, ADFA Examinations end University College, ADFA Mid-year recess begins Su 6 Ť
- Examinations end for Faculties other than 8 Medicine, AGSM and University College, ADFA
- w 9 Mid-year recess begins - for Faculties other than Medicine, AGSM and University College, ADFA
- AGSM EMBA GMQ and GDM programs -M 14 Session 2 begins
- University College, ADFA Mid-year recess ends University College, ADFA Session 2 begins Medicine VI Term 4 ends Medicine VI Recess begins Su 20
- 21 25 М F
- s 26
- Su 27 Mid-year recess ends - for Faculties other than Medicine, AGSM and University College, ADFA
- M 28 Session 2 begins - for Faculties other than Medicine, AGSM and University College, ADFA

#### August 1997

- ้3 Medicine VI – Recess ends Medicine VI – Term 5 begins Su
- M ă Ē Last day applications are accepted from students Ŕ to enrol in Session 2 subjects Last day for students to discontinue without failure subjects which extend over the whole academic year AGSM MBA program - all classes - Term 2 ends
- Medicine IV Term 4 ends Medicine V Term 3 ends Su 10
- AGSM MBA program all classes Examinations begin Medicine IV Recess begins M 11
- AGSM MBA program all classes -E 15 Examinations end
- Su 17
- Medicine IV Recess ends Medicine IV Term 5 begins M 18
- Medicine V Term 4 begins Su 31 Last day for students to discontinue without failure subjects which extend over Session 2 only HECS Census Date for Session 2

#### September 1997

- М AGSM MBA program - all classes - Term 3 begins
- S 6 Su 14
- Open Day Medicine VI Term 5 ends Medicine VI Term 6 begins 15 М
- F Closing date for applications to the Universities 26 Admission Centre s
- Mid-session recess begins for Faculties other than 27 Medicine and AGSM
- University College, ADFA September recess begins
- Su 28 Medicine IV - Term 5 ends
- M 29 Medicine IV - Term 6 begins

#### October 1997

- Labour Day Public Holiday м 6 Mid-session recess ends - for Faculties other than Medicine and AGSM University College, ADFA - September recess ends
- т 7 Publication of provisional timetable for the November examinations
- w 15 Last day for students to advise of examination clashes
- AGSM EMBA Executive Year Session 2 ends Medicine V Term 4 ends F 17
- Su 19
- University College, ADFA Session 2 ends F 24 Su 26
- Medicine VI Term 6 ends
- м 27 University College, ADFA - Examinations begin
- т 28 Publication of timetable for November examinations

#### November 1997

- AGSM EMBA GDM program Session 2 ends AGSM EMBA GDM program Examination s 1
- F 7 Session 2 ends - for Faculties other than Medicine.
- AGSM and University College, ADFA AGSM MBA program all classes Term 3 ends Study period begins for Faculties other than Medicine, S 8 AGSM and University College, ADFA AGSM EMBA GMQ program -AGSM EMBA GMQ program – Examination AGSM EMBA GMQ program – Examination Medicine IV – Term 6 ends
- Su 9
- AGSM MBA program all classes Examinations begin Study period ends for Faculties other than M 10 Th 13
- Medicine, AGSM and University College F 14 Examinations begin – for Faculties other than Medicine , AGSM and University College AGSM MBA program – all classes – Examinations end University College, ADFA – Examinations end

#### December 1997

- Examinations end for Faculties other than 2 т
- Medicine, AGSM and University College, ADFA Th 25
- Christmas Day Public Holiday Boxing Day Public Holiday F
- 26

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; as well as Centres located within Schools- Applied Polymer Science, Bioengineering, Minerals Engineering, Particle and Catalyst Technologies, Key Centre for Mines and the UNESCO Centre for Membrane Science and Technology. The Faculty is also associated with the Energy Research, Development and Information Centre (ERDIC), the UNSW Groundwater Centre and the Centre for Remote Sensing and Geographic Information Systems. It houses the Cooperative Research Centres for Biopharmaceutical Research and Food Industry Innovation.

#### Dean

Professor Gerald James Spurgeon Govett, DSc Wales, PhD DIC Lond., CEng, FIMM, FIEAust, CPEng

Presiding Member Associate Professor Rodney Phillip Chaplin, BSc PhD Salford, CChem, MACS, FRACI

Associate Dean Gordon Whitfield King, BSc PhD UNSW, DipFinMgt N.E., MAIAS, AASA, CPA

#### Executive Officer Position vacant

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

Workshop Manager Graham Lesley Millett

Faculty Information Technology Manager Andrew William Cox, BAppSc UTS

Officer-In-charge, Drawing Office Narendra Mohan Saha Chaudhury, BME Jadavpur, MIEAust

Administrative Assistant Wendy Margaret Wartho

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

Scientific Illustration Unit Stephen George Preece, AAIMBI

# **School of Applied Bioscience**

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

Professor of Food Science and Technology and Head of Department of Food Science and Technology Kenneth Alan Buckle, BSc PhD UNSW, FTSE, FAIFST, FCIA, MIFT

#### Department of Biotechnology

Head of Department of Biotechnology Professor PP Gray

#### Professors

Peter Lindsay Rogers, BE Adel., MBA UNSW, DPhil DSc Oxf.

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

\*Conjoint appointment with The Garvan Institute of Medical Research.

#### **Associate Professor**

Pauline Mavis Doran, BE *Qld.*, MSc PhD *CalTech.*, MIChemE

#### Lecturers

Frances Chooi Foung Foong, BSc *Sur.*, MS *UPM*, PhD *UC Davis* Dianne Glenn, BSc PhD *UNSW* Stephen Michael Mahler, BSc *Syd.*, PhD *Qld.* Christopher Peter Marquis, BSc BE PhD *Syd.* 

#### **Professional Officers**

Russell George Cail, DipBiochem Bendigo I. T., PhD UNSW Malcolm Hilary Noble, BSc Macq. MEnvStud UNSW John Alton Ide, BSc PhD UNSW Rose Ann Varga, BSc UNSW Jeffrey Harold Welch, BSc UNSW

Administrative Officer Robin Lee

Visiting Professor Wayne Lyle Gerlach, BSc PhD Adel.

Visiting Fellows Nigel Morrison, BSc *Qld.*, PhD A.N.U. Peter Robert Schofield, BScAgr Syd., PhD A.N.U.

#### **Bioengineering Centre**

Director Professor PP Gray

Deputy Director Professor J Shine

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

#### Cooperative Research Centre for Food Industry Innovation

Director Professor NW Dunn

Business Manager Dr RJ Lucas

Administrative Assistant Ms J Quennell

#### Department of Food Science and Technology

Head of Department of Food Science and Technology Professor KA Buckle

#### Professor

Graham Harold Fleet, MSc Qld, PhD UC Davis, FASM, FAIFST

#### Associate Professors

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

#### Senior Lecturers

Robert Hilton Driscoll, BSc A.N.U., PhD UNSW, AAIFST MaryAnn Filadelfi-Keszi, BSc Concordia, MSc McGill, PhD Guelph, MIFT, AAIFST

#### Lecturers

Jayashree Arcot, MSc *Madras*, PhD *Hyd.*, AAIFST Julian Michael Cox, BSc PhD *Qld*, AAIFST, MASM Janet Lorraine Paterson, BSc PhD *UNSW*, DipEd *UNE*, AAIFST Jane Elizabeth Paton, BSc PhD *UNSW*, AAIFST

Administrative Officer Richard John Greenwood, BA UNSW

#### **Professional Officers**

Maxwell Robert Bell, BSc MAppSc UNSW, ASTC Yvone ElGhetany, BScAg Ains Shams, MSc UNSW Zbigniew Suminski, ME(Food Tech) Olstzyn

#### **Honorary Visiting Fellow**

Kevin Joseph Scott, BSc(Agr) DipEd Syd.

#### Visiting Fellow

John David Craske, MSc PhD UNSW, ASTC, FRACI, FTSE, AAIFST

### School of Chemical Engineering and Industrial Chemistry

#### Professor of Chemical Technology and Head of School

David Lawrence Trimm, BSc PhD *Exe.*, DIC *Lond.*, CPEng, FTSE, FRACI, FIChemE, FIEAust

# Professors of Chemical Engineering and Industrial Chemistry

Anthony Gordon Fane, BSc PhD DIC Lond., CPEng, FIChemE, FIEAust

Christopher Joseph Dalzell Fell, BSc UNSW, PhD Camb., CPEng, FTSE, FIChemE, FIEAust, AICLE

Neil Russell Foster, BSc PhD UNSW, FRACI, AICLE, ACS Maria Skyllas-Kazacos, BSc PhD UNSW, FRACI, MES, FIEAust., CPE

Mark Sebastian Wainwright, MAppSc Adel., PhD McM., FRACI, FIEAust, CPEng, FTSE

#### **Associate Professors**

Michael Paul Brungs, BSc PhD UNSW, FSGT RP Chaplin Robert Paul Burford, BSc PhD Adel., FPRI(Aust), FRACI Judy Agnes Raper, BE PhD UNSW, CPEng, MIChemE

#### Senior Lecturers

Adesoji Adediran Adesina, BSc Lagos, MASc PhD Waterloo

Rose Amal, BE PhD UNSW, MIChemE

Phillip Thomas Crisp, BSc PhD Syd., ARACI

Thomas Paul Davis, BSc PhD Salford, CChem, MRSC Douglas Christopher Dixon, BE MEngSc Syd., PhD UNSW, MIEAust

John Ruang Pham, BE PhD Cant., MIChemE, AAIFSP John Frank Stubington, BE Qld., PhD Camb., CEng, FAIE, MIChemE

Tam Tran, BSc PhD UNSW, MAusIMM, MAIME Dianne Elizabeth Wiley, BAppSc D.D.I.A.E., DipEd Armidale C.A.E., PhD UNSW, CChem, ARACI

#### Lecturers

Vicki Chen, BSc(Eng) MIT, PhD Minnesota, MAIChE, ACS Lloyd Johnston, BSc(Eng) *Queens*, MSCEP, PhD *MIT*, MAIChE

Frank Lucien, BE PhD UNSW Roya Sheikholeslami, BSc Kansas, MASc PhD British Columbia, PEng, MAIChE, MCICE

#### Associate Lecturer

Anthony John Papagelis, BE UNSW

#### Administrative Officer Kim Maree Mason, BA Charles Sturt

#### **Professional Officers**

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

Computer Systems Officer Frank Fan, BSc ME UNSW

#### Department of Chemical Engineering

#### Head

Associate Professor JA Raper

#### **Department of Industrial Chemistry**

#### Head

Associate Professor MP Brungs

### **Centre for Applied Polymer Science**

Director Associate Professor RP Burford

#### **Centre for Particle and Catalyst Technologies**

Director Associate Professor JA Raper

# UNESCO Centre for Membrane Science and Technology

(in association with the Faculty of Science)

Director, Chemical Engineering Professor AG Fane

Director, Biophysics Professor HG Coster

# School of Fibre Science and Technology

Professor of Wool Technology and Head of School Ross Ernest Griffith, BSc UNSW, PhD Leeds, CText, FTI

Administrative Officer Frances Colville

#### Department of Textile Technology

Professor and Head of Department Michael Thomas Pailthorpe, BSc PhD UNSW, CText, FTI, MSDC(ANZ), JP

#### Professor of Textile Physics Ronald Postle, BSc UNSW, PhD Leeds, CText, FTI, FAIP, Hon. Docteur, Haute Alsace

#### Senior Lecturers

John Ilmar Curiskis, BSc PhD UNSW

#### 8 APPLIED SCIENCE

#### Lecturers

Shantha Kumari David, MSc *Waik.*, PhD *Br.Col.,* MSDC (*ANZ*)

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

Anthony John Madeley, BSc PhD UNSW, MSc Macq., DipEd Mitchell C.A.E.

#### Lecturers

Kevin Dunn, BA *W'gong.* Allan Evans, BSc *Altberta* Jesmond Sammut, BSc *UNSW\** 

Associate Lecturers David John Edwards, BSc N'cle. (N.S.W.) Allison Louise Charleton Jones, BA Adel. Beverley Ann Scott, BA Macq.

Professional Officer Chris Anthony Myers, BSc UNSW

Administrative Officer Philip Robert Dulhunty, BArtEd UNSW\*

#### **Department of Wool and Animal Science**

Senior Lecturer and Head of Department Geoffrey Edward Robards, BSc UNSW, PhD Melb.MASAP

#### Associate Professors

David John Cottle, BSc UNSW, PhD N.E. John William James, BA Qld., DSc UNSW

#### Senior Lecturers

Douglas McPherson Murray, BAgrSc PhD *Melb.*, MRurSc *N.E.* 

Lecturer Peter Douglas Auer, BSc PhD UNSW

Professional Officers David John Petrie, BSc UNSW

Project Officer Jeffrey Eppleston, MScAg Syd, PhD UNSW

# **School of Geography**

#### Associate Professor and Head of School Marilyn Dale Fox, BSc Windsor, PhD Macq.

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

#### **Associate Professors**

Ian Harry Burnley, MA *Cant.*, PhD *Well.* Michael Dick Melville, BScAgr PhD *Syd.* Anthony Kinnaird Milne, BA *N.E.*, MA *Syd.*, PhD *Colorado* 

#### Senior Lecturers

Wayne David Erskine, BA PhD UNSW Stephen James Filan, BAgEc N.E., MSc UNSW Bruno Peter John Parolin, BA Monash, MS Oklahoma State, PhD Ohio State Morgan Eugene Cyril Sant, BA Keele, MSc PhD Lond. Qiming Zhou, BSc Beijing Normal, PhD UNSW

# School of Materials Science and Engineering

# Professor of Materials Science and Engineering and Head of School

David John Young, BSc PhD Melb., FRACI, FIEAust, CPEng, MAmerIChE, FTS

#### Associate Professor

Oleg Ostrovski, Diplng(Met) PhD DSc *MISiS, Moscow,* MIEAust Charles Christopher Sorrell, BS *Missouri,* MS *Penn.,* PhD *UNSW,* FIEAust, DipDT, FGAA, NICE

#### Senior Lecturers

Sri Bandyopadhyay, BTech MTech I.I.T. PhD Monash, FIEAust, CPEng MRACI, MAAAS Alan Crosky, BSc PhD UNSW. Brian Gleeson, MSc W. Ontario, PhD UCLA Peter Krauklis, BSc PhD UNSW, MIEAust, MIM, CEng, CPEng Sviatoslav Antonovich Prokopovich, MSc UNSW, ASTC, CPEng, MIEAust Veena Sahajwalla, MSc, PhD Mich., MIBF, MAIE Aibing Yu, MSc(Eng) N.E.U.T., China, PhD W'gong.

#### Lecturer

Patrick Wong, BE PhD UNSW, MAutoIMM

#### Honorary Visiting Professor

Max Hatherly, MSc PhD UNSW, ASTC, CPEng, FTS, FIM

#### Professional Officers

James Howells, BSc UNSW John Walton Sharp, BScTech UNSW

#### Administrative Assistant

Ole Staer Andersen, MAgr *Copenhagen*, MGenStud UNSW

## **School of Mines**

#### Associate Professor and Head of School

Geoffrey Robert Taylor, MSc Birm., PhD N.E., FGS, MIMM, MAusIMM

#### Visiting Professors

Miklos Dezso Gyorgy Salamon, Diplng(MIN) Sopron., PhD Durh., Hon.DSc Miskolc, CEng, MAmIME, FIMM, MAIME, FSAIMM

#### Administrative Officer

Rosi Benninghaus

Administrative Assistant Kim Russell

### **Department of Applied Geology**

Associate Professor and Head of Department Colin Rex Ward, BSc PhD UNSW, FAusIMM, FAIG

#### **Professors of Geology**

GJS Govett John Roberts, BSc N.E., PhD W.A.

#### **Associate Professors**

Alberto Domenico Albani, DrGeolSc *Florence*, MSc PhD UNSW Bastiaan Jan Hensen, MSc Ley., PhD A.N.U.

#### Senior Lecturers

Alistair Chisholm Dunlop, BSc N.E., PhD Lond., DIC, MIMM Michael Barry Katz, BSc Mich.T.U., MSc McG., PhD Tor. Paul Gordon Lennox, BSc Tas., PhD Monash Jerzy Jankowski, MSc PhD Wroclaw Gregory Hugh McNally, BSc Syd., BA N.E., MAppSc UNSW, DIC, MIE Aust Derecke Palmer, MSc Syd. Peter Cyril Rickwood, BSc Lond., PhD Cape T., CChem, MRCS, MMSA

#### Lecturers

Malcolm David Buck, MSc Waik., PhD Macq. David Ronald Cohen, BSc Syd., MSc Queens., PhD UNSW, FAEG, CEA

Adjunct Lecturer Anton Crouch, BA BSc Syd., PhD MAIG

#### Administrative Assistant Jaala Clifford

Honorary Visiting Fellow Ervin Slansky, BSc PhD RnDr Charles

#### **Honorary Associates**

Frederick Charles Loughnan, BSc Syd., PhD DSc UNSW Edward Tyne, BSc GradDip(Geophys) PhD UNSW

Research Associate Andreas Moeller, PhD Kiel, MDMG, MEUG, MGSA

Vice-Chancellor's Post-Doctoral Fellow Leo Marcel Kriegsman, MSc PhD Utrecht

Professional Officers Zaynab Fidahusayn Muhammad Aly, MSc Lond.

#### **Department of Mining Engineering**

# Professor of Mining Engineering and Head of Department

James Maurice Galvin, BSc BE Syd., PhD Wits, FAusIMM, FIEA, FIEAust, MISRM

#### Kenneth Finlay Chair of Rock Mechanics Professor

Bruce Kenneth Hebblewhite, PhD N'cle. (U.K.), DipAICD N.E., MAUSIMM, MAMIME, MISRM

#### Senior Lecturers

Anthony Charles Partridge, BSc Leeds, MSc PhD McG., CEng, MIMM Venkata Satyanarayana Vutukuri, BScEng Ban., MS Wisconsin., PhD Tech.Sc Poland, MAmIME John Ormiston Watson, BScEng Nott., PhD S'ton.

#### Lecturers

Christopher Raymond Daly, BE MSc(Acoustics) PhD UNSW, GradDip(MinEcs), GradDip(Higher Ed.)Macq. MAIME, MAusIMM Drago Panich, BE UNSW, MSc N'cle.(U.K.)

#### Visiting Professor of Mining Engineering

Frank Ferdinand Roxborough, BSc PhD Durh., CPEng, CEng, FIEAust, FIMM, FAUSIMM, FIMINE

#### **Visiting Fellow**

Amal Krishna Bhattacharyya, BSc Glas., MSc Durh., PhD N'cle. (U.K.), CEng, MAMIME, FIMINE, FAusIMM, MCIMM, PEng

#### Professional Officer

Bin Lin, ME P.R.China

#### Administrative Assistant Carol Vallance

#### **Centre for Minerals Engineering**

#### **Co-Directors**

Anthony Charles Partridge Tam Tran

#### Key Centre for Mines

Director Michael Barry Katz

#### Associate Directors

Christopher Raymond Daly David Ronald Cohen

#### **Visiting Fellows**

Susan Nicola Border, BSc *Lond*, GradDip *NSWIT* Stephen Geoffrey Gemell, BE *Syd.*, FAusIMM, AIMMPE Edmund James Malone, MSc *Syd.*, MBA *Macq.*, FAusIMM, FAIM, MGSA

#### Administrative Assistant Kim Russell

### Centre for Petroleum Engineering Studies

#### Director

Wolf Val Pinczewski, BE N'cle(N.S.W.), PhD UNSW, CPEng, MIChemE

#### Visiting Professors Ferda Akgun, BSc Ankara, MSc U.S.L., PhD C.S.M. Ashok Kumar Khurana, BSc Jabalpur, BE B'lore, GradDip Birm., PhD DIC Lond.

Senior Lecturers Henry Alfred Salisch, BSc Quito Poly. Inst., MSc Oklahoma, MS Venezuela Central Sheikh Rahman, BSc Chitt., MSc Strath., PhD Clausthal

Visiting Lecturers Guy Allinson, BSc Leeds., DipSocSci Birm. Richard Christian Curnow, BE Syd., BCom UNSW Barry Walsh, BE PhD Syd.

Professional Officer Juan Carlos Zajaczkowski, BE *Buenos Aires* 

**Department of Safety Science** 

Professor of Safety Engineering and Head of

Administrative Assistant Jennifer Ruth Lippiatt

#### Administrative Assistant Barbara Littlewood

Visitina Fellows

Neil Leon Adams, BSc PhD UNSW, MESA, MHFS, MAITD, MICOH Edward Maxwell Nicholls, MD BS Adel., FACOM Keith Post, BE PhD UNSW Ronald Rosen, MSc N.Z., PhD UNSW, CPhys, FInstP, FAIP, FIPSM, FARPS, MACPSEM

\*Conjoint appointment with the Faculty of Medicine.

### Energy Research Development and Information Centre (ERDIC)

Director Position vacant

# Centre for Remote Sensing and Geographic Information Systems

(in association with the Faculty of Engineering)

#### **Director and Professor**

Bruce Crosby Forster, MSurv Melb., MSc R'dg., PhD UNSW, MISAust, LSVic, MIEEE

# bD Lond EIEAust MIEE MAIP

Jean Cross, BSc Manc., PhD Lond., FIEAust, MIEE, MAIP, CEng

Visiting Professor of Mechanical Engineering \*Noel Levin Svensson, AM, MMechE PhD *Melb.*, CEng, CPEng, FIEAust, MIMechE

#### Associate Professor

Chris Winder, BA Open U., MSc City Lond., PhD Lond.

#### Lecturers

Department

Dianne Heather Gardner, BA Adel., MPsychol UNSW Roger Roy Hall, BSc A.N.U., MSc UNSW, FESA Kamal Kothiyal, MSc MTech PhD I.I.T. Delhi

**Professional Officers** 

Shaharin Yussof, BEng Car.

# **UNSW Groundwater Centre**

(in association with the Faculty of Engineering)

Director Dr J Jankowski

Senior Lecturer

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

# Handbook Guide

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 **Summary of Courses** (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 point 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 Summary of Courses.** 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 **Graduate Study Summary of Courses**. 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:

| СР  | credit points  |
|-----|--|
| F   | full year (Session 1 plus Session 2)   |
| HPW | hours per week   |
| L   | lecture  |
| P/T | Part-time  |
| S1  | Session 1  |
| S2  | Session 2  |
| SS  | single Session, but which Session taught is not known at time of publication |
| Т   | tutorial/laboratory  |
| U   | unit value   |
| WKS | weeks of duration  |
| х   | external   |

### Prefixes

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

| Prefix | Organisational Unit   | Faculty/Board                       |
|--------|---|-------------------------------------|
| ABIO   | School of Applied Bioscience                                      | Applied Science                     |
| ACCT   | School of Accounting  | Commerce and Economics              |
| ANAT   | School of Anatomy   | Medicine                            |
| APSE   | Faculty of Applied Science  |                                     |
| BIOC   | School of Biochemistry  | Biological and Behavioural Sciences |
| BIOM   | Centre for Biomedical Engineering                                 | Engineering                         |
| BIOS   | School of Biological Science                                      | Biological and Behavioural Sciences |
| BIOT   | Department of Biotechnology                                       | Applied Science                     |
| CEIC   | School of Chemical Engineering and                                | Applied Opieron                     |
| CHEM   | Sebeel of Chemistry   | Applied Science                     |
|        | Department of Charries LEssingering                               | Science                             |
|        | Sebeel of Civil Espineering                                       | Applied Science                     |
| CMED   | School of Civil Engineering                                       | Engineering                         |
| COMED  | School of Community Medicine                                      |                                     |
| COMP   | School of Computer Science and Engineering                        | Engineering                         |
| ECOH   |   | Commerce and Economics              |
| ECON   | School of Economics, Departments of<br>Econometrics and Economics | Commerce and Economics              |
| ELEC   | School of Electrical Engineering                                  | Engineering                         |
| ENVS   | Environmental Studies   | Biological and Behavioural Sciences |
| FIBR   | School of Fibre Science and Technology                            | Applied Science                     |
| FINS   | School of Banking and Finance                                     | Commerce and Economics              |
| FOOD   | Department of Food Science and Technology                         | Applied Science                     |
| FUEL   | Department of Fuel Technology                                     | Applied Science                     |
| GEOG   | School of Geography   | Applied Science                     |
| GEOL   | Department of Applied Geology                                     | Applied Science                     |
| GMAT   | School of Geomatic Engineering                                    | Engineering                         |
| GSBE   | Graduate School of the Built Environment                          | Built Environment                   |
| HEAL   | School of Health Services Management                              | Professional Studies                |
| INDC   | Department of Industrial Chemistry                                | Applied Science                     |
| INFS   | School of Information Systems                                     | Commerce and Economics              |
| IROB   | School of Industrial Relations and<br>Organisational Behaviour    | Commerce and Economics              |

| Prefix | Organisational Unit                                   | Faculty/Board                              |
|--------|---|--|
| KCME   | Key Centre for Mines                                  | Applied Science                            |
| LAND   | School of Landscape Architecture                      | Built Environment                          |
| LEGT   | Department of Legal Studies and Taxation              | Commerce and Economics                     |
| LIBS   | School of Information, Library and<br>Archive Studies | Professional Studies                       |
| MANF   | School of Mechanical and Manufacturing<br>Engineering | Engineering                                |
| MARK   | School of Marketing                                   | Commerce and Economics                     |
| MATH   | School of Mathematics                                 | Science                                    |
| MATS   | School of Materials Science and Engineering           | Applied Science                            |
| MECH   | School of Mechanical and Manufacturing<br>Engineering | Engineering                                |
| MEED   | School of Medical Education                           | Medicine                                   |
| MICR   | School of Microbiology and Immunology                 | <b>Biological and Behavioural Sciences</b> |
| MINE   | Department of Mining Engineering                      | Applied Science                            |
| MINP   | Centre for Minerals Engineering                       | Applied Science                            |
| MNGT   | Australian Graduate School of Management              |  |
| MSCI   | Board of Studies in Science and Mathematics           | 3  |
| PHYS   | School of Physics                                     | Science                                    |
| PLAN   | School of Town Planning                               | Built Environment                          |
| POLY   | Department of Polymer Science                         | Applied Science                            |
| PROF   | Faculty of Professional Studies                       |  |
| PSYC   | School of Psychology                                  | Biological and Behavioural Sciences        |
| PTRL   | Department of Petroleum Engineering<br>Studies        | Applied Science                            |
| SAFE   | Department of Safety Science                          | Applied Science                            |
| SOCI   | School of Sociology                                   | Arts and Social Sciences                   |
| SCTS/  | School of Science and                                 |  |
| HPST   | Technology Studies                                    | Arts and Social Sciences                   |
| TEXT   | Department of Textile Technology                      | Applied Science                            |
| WOOL   | Department of Wool and Animal Science                 | Applied Science                            |
|        |   |  |

14 APPLIED SCIENCE

# **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. (02) 9385 4469

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

#### Biotechnology

Ms R Lee, Administrative Officer, Room 110A, Biological Sciences Building. Tel. (02) 9385 2050

**Chemical Engineering and Industrial Chemistry** 

Ms K Mason, Administrative Officer, Room 316, Applied Science Building. Tel. (02) 9385 4318.

#### Food Science and Technology

Mr R Greenwood, Administrative Officer, Room 115, Building B8A. Tel. (02) 9385 4364.

#### Geography

Mr P Dulhunty, Administrative Officer, Room 139, Geography and Surveying Building. Tel. (02) 9385 4390.

#### **Materials Science and Engineering**

Mr O Andersen, Administrative Assistant, Room 110B, Materials Science and Engineering Building. Tel. (02) 9385 4436.

#### Mines (Applied Geology and Mining Engineering)

Ms R Benninghaus, Administrative Officer, Room 810, Applied Science Building. Tel. (02) 9385 4262

#### **Petroleum Engineering**

Ms J Lippatt, Room 115, Petroleum Engineering Building. Tel. (02) 9385 5188.

#### Safety Science

Ms B Littlewood, Administrative Assistant, Hut B, 11a, Room111. Tel. (02) 9385 4144.

#### **Textile Technology and Wool and Animal Science**

Ms F Colville, Administrative Officer, Room 102, Sir Robert Webster Building. Tel. (02) 9385 4477.

# **Enrolment Procedures**

All students re-enrolling in 1997 or enrolling in graduate courses should obtain a copy of the free leaflet *ReEnrolling in 1997* available from School Offices and the Student Centre. This leaflet provides detailed information on enrolment procedures and fees, enrolment timetables by Faculty and course, enrolment in miscellaneous subjects, locations, cashier hours and procedures for 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; specialised 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, the EEO Unit, the 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 9385 5418 or at Student Services, Quadrangle Building.

# Equal Opportunity in Education Policy Statement

Under the Federal Racial Discrimination Act (1975), Sex Discrimination Act (1984), Disability Discrimination Act (1992) and the New South Wales Anti-Discrimination Act (1977), the University is required not to discriminate against students or prospective students on the grounds of sex, marital status, pregnancy, race, nationality, national or ethnic origin, colour, homosexuality or disability. Under the University of New South Wales Act (1989), the University declares that it will not discriminate on the grounds of religious or political affiliations, views or beliefs.

# University Commitment to Equal Opportunity in Education

As well as recognising its statutory obligations as listed, the University will eliminate discrimination on any other grounds which it deems to constitute disadvantage. The University is committed to providing a place to study free from harassment and discrimination, and one in which every student is encouraged to work towards her/his maximum potential. The University further commits itself to course design, curriculum content, classroom environment, assessment procedures and other aspects of campus life which will provide equality of educational opportunity to all students.

#### **Special Admissions Schemes**

The University will encourage the enrolment of students who belong to disadvantaged groups through programs such as the University Preparation Program and the ACCESS Scheme. Where members of disadvantaged groups are particularly under-represented in certain disciplines, the responsible faculties will actively encourage their enrolment.

#### Support of Disadvantaged Students

The University will provide support to assist the successful completion of studies by disadvantaged group members through such means as the Aboriginal Education Program, the Supportive English Program and the Learning Centre. It will work towards the provision of other resources, such as access for students with impaired mobility, assistance to students with other disabilities, the provision of a parents' room on the upper campus, and increased assistance with English language and communication.

# Course Content, Curriculum Design, Teaching and Assessment, and Printed Material

Schools and faculties will monitor course content (including titles), teaching methods, assessment procedures, written material (including study guides and handbook and Calendar entries) and audiovisual material to ensure that they are not discriminatory or offensive and that they encourage and facilitate full participation in education by disadvantaged people.

#### Equal Opportunity Adviser Scheme

The University will continue its Equal Opportunity Adviser Scheme for students who feel that they have been harassed or who consider they have been disadvantaged in their education by practices and procedures within the University.

#### **Harassment Policy**

The University is committed to ensuring freedom from harassment for all people working or studying within the institution. It will continue to take action, including disciplinary action, to ensure that freedom from harassment is achieved.

# **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, Food Science and Technology and the Department of Safety Science. It is closely associated with 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 Level 3 of the Library Building.

Biomedical Library staff are available at the Information Desk on Level 2 Mathews Building to provide reference services and to assist in the use of the catalogues. Instructional classes in the use of the library and specific subject material can be arranged through the Information Desk.

Serials in the Biomedical Library are shelved in alphabetical order by title and carry the prefix MB or MBQ. Details about Biomedical Library books, serials and audiovisual material can be found in the Library Catalogue.

In addition the Biomedical Library offers the following services and facilities: literature searches; on-site and remote access to a wide range of bibliographic databases; and a document supply service for external and remote students.

#### The Physical Sciences Library

The Physical Sciences Library, located on levels 5, 6 and 7 of the Library Building, provides information for students and staff from the Faculties of Science, Engineering, the Built Environment and Applied Science.

During the academic year the Library is open from 8.00 am to 10.00 pm Monday to Thursday, 8.00 am to 6.00 pm on Friday and 12.00 pm to 5.00 pm Saturday and Sunday. During vacations, Library hours of opening will vary.

Staff assisted service is available after 10.00 am including help with the catalogue, CD Roms, inter-library loans,

maps and online searching. An information skills program is in place with emphasis on developing basic information access and management skills for first years and advanced skills for final year and postgraduate students.

The Library's catalogue and selected CD-Rom databases are available over the Campus Wide Network.

# **Computing Requirements**

A number of courses in the Faculty of Applied Science have certain computing requirements. To obtain details of these, each student should contact the appropriate School Office in the first weeks of first session.

# **Computing at UNSW**

The Division of Information Services (DIS) encompasses information technology and the University Library at UNSW.

Specific University information which is frequently updated is available on the World Wide Web (WWW) in the UNSW home page at http://www.unsw.edu.au which has an index to its contents which includes URLs http://www.acsu.unsw.edu.au and http://www.misu. unsw.edu.au. You can access this information from your workstation and in any computing laboratory with access to WWW through Mosaic or Netscape.

The information provided on the WWW includes more details about DIS information technology units such as points of contact for particular areas of responsibility and services provided.

### 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 progamd 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 Program**

UNSW requires that all undergraduate students undertake a structured program in general education as an integral part of studies for their degree.

The University believes that a General Education complements the more specialised learning undertaken in a student's chosen field of study and contributes to the flexibility which graduates are increasingly required to demonstrate. Employers repeatedly point to the complex nature of the modern work environment and advise that they highly value graduates with the skills provided by a broad general education, as well as the specialised knowledge provided in more narrowly defined degree programs. As well, over many years graduates of this University have reported that they greatly valued their General Education studies, which are found to be relevant to both career and personal development.

The General Education Program at UNSW intends to broaden students' understanding of the environment in which they live and work and to enhance their skills of critical analysis.

#### **Objectives of the General Education Program**

The following objectives were approved by the Council of the University in December 1994.

1. To provide a learning environment in which students acquire, develop, and deploy skills of rational thought and critical analysis.

2. To enable students to evaluate arguments and information.

**3.** To empower students to systematically challenge received traditions of knowledge, beliefs and values.

4. To enable students to acquire skills and competencies, including written and spoken communication skills.

5. To ensure that students examine the purposes and consequences of their education and experience at University, and to foster acceptance of professional and ethical action and the social responsibility of graduates.

6. To foster among students the competence and the confidence to contribute creatively and responsibly to the development of their society.

7. To provide structured opportunities for students from disparate disciplines to co-operatively interact within a learning situation.

8. To provide opportunities for students to explore discipline and paradigm bases other than those of their professional or major disciplinary specialisation through non-specialist subjects offered in those other areas.

**9.** To provide an environment in which students are able to experience the benefits of moving beyond the knowledge boundaries of a single discipline and explore cross- and interdisciplinary connections.

**10.** To provide a learning environment and teaching methodology in which students can bring the approaches of a number of disciplines to bear on a complex problem or issue.

#### **General Education requirements**

The basic General Education requirements are the same for students in all courses:-

 Four (4) session length subjects carrying a minimum of 7.5 credit points each or their equivalent, in combinations of session length and year long subjects.  An additional fifty-six (56) hours of study which foster acceptance of professional and ethical action and social responsibility. This fifty-six hours of study may be distributed throughout the course, or exist as a separate subject, depending on the course.

Because the objectives of General Education require students to explore discipline and paradigm bases other than those of their professional or major disciplinary specialisation. Students cannot choose as a General Education subject one which if offered by a school which offers another subject in their program.\_

Each Faculty has responsibility for deciding what subjects are *not* able to be counted towards the General Education requirement for their students. In most cases, this means that subjects offered by the Faculty in which a student is enrolled, or subjects which are a required part of a course even though offered by another Faculty, are *not* able to be counted toward the General Education requirement.

Students should consult the General Education Handbook for detailed information about what subjects may and may not be taken to fulfil the General Education requirements for each course offered by the Faculty. The General Education Handbook is freely available from all Faculty Offices.

# Additional information for undergraduate students who first enrolled before 1996

#### Transitional arrangements

It is intended that no student will be disadvantaged by the change to the new General Education Program. The old Program had specific requirements to complete four session length subjects (or their equivalent) in designated categories A and B. The new General Education Program does not categorise subjects in the same way.

As a result, students who enrolled prior to 1996 will be given full credit for any General Education subjects completed up to the end of Session two 1995.

From the summer session of 1995-96, students will be required to satisfy the unfilled portion of their General Education requirement under the terms of the new Program.

The exemption of General Education requirements for some double or combined degree programs will continue to apply for students who enrolled in these exempt courses prior to 1996.

# Undergraduate Study Summary of Courses

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).

#### Industrial Training

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.

#### 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.

#### **Computing Requirements**

A number of courses in the Faculty of Applied Science have certain computing requirements. To obtain details of these, each student should contact the appropriate School Office in the first weeks of first session.

# **Full-time Courses**

These courses are of four years' duration as follows:

#### Bachelor of Science BSc

| Applied Geology<br>Applied Physical Geography<br>Applied Economic Geography<br>Human and Physical Resources (Physical)<br>Human and Physical Resources (Economic)<br>Biotechnology<br>Food Science and Technology<br>Honours in Food Science<br>Industrial Chemistry<br>Textile Design and Technology*<br>Textile Design and Technology<br>Wool and Pastoral Sciences | 3000<br>3010.1000<br>3010.2000<br>3010.4000<br>3052<br>3060<br>3065<br>3100<br>3177<br>3170<br>3220 |
|---|---|
| Bachelor of Engineering<br>BE   |   |
| Bioprocess Engineering<br>Ceramic Engineering<br>Chemical Engineering<br>Mining Engineering<br>Petroleum Engineering  | <b>3055</b><br><b>3025</b><br><b>3040</b><br><b>3140</b><br>3045                                    |
| Bachelor of Metallurgical Engineering<br>BMetE  |   |
| Metallurgical Engineering   | 3125  |
| Bachelor of Materials Engineering<br>BMatE  |   |
| Materials Engineering   | 3615  |

### **Part-time Courses**

Six-year part-time courses leading to the award of the degree of Bachelor of Science (Technology) 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.

#### Bachelor of Science BSc

| Applied Geology                               | 3000 |
|---|------|
| Bachelor of Science (Technology)<br>BSc(Tech) |      |
|   |      |

| Ceramic Engineering         | 3030 |
|-----------------------------|------|
| Chemical Engineering        | 3050 |
| Food Science and Technology | 3070 |
| Industrial Chemistry        | 3110 |
| Metallurgy                  | 3130 |
| Textile Management          | 3175 |
|                             |      |

# **Combined Degree Courses**

A five-year combined degree course is available in Civil Engineering and Mining Engineering **3146**. Students initially enrol in Civil Engineering, and Mining Engineering subjects are taken in Year 4 and Year 5.

Because the first two years of the Petroleum Engineering course are identical to the first two years of the Chemical Engineering course, it is possible, upon completion of the Petroleum Engineering program, to obtain a double BE degree in Petroleum and Chemical Engineering **3046** with one additional year of study.

# Engineering Courses in the Faculty of Engineering

The University of New South Wales is unique in that engineering degrees area offered by two faculties, the Faculty of Applied Science and the Faculty of Engineering.

Engineering undergraduate courses (excluding combined degrees) available in the Faculty of Engineering are as follows:

#### Bachelor of Engineering BE

| Aerospace Engineering     | 3610 |
|---------------------------|------|
| Civil Engineering         | 3620 |
| Computer Engineering      | 3645 |
| Electrical Engineering    | 3640 |
| Environmental Engineering | 3625 |
| Geomatic Engineering      | 3741 |
| Manufacturing Management  | 3663 |
| Mechanical Engineering    | 3680 |
| Mechatronic Engineering   | 3685 |
| Naval Architecture        | 3700 |
| Software Engineering      | 3648 |

These full-time courses are designed to be taken over a period of four years. They may also be taken on a part-time basis which usually involves a combination of mainly day-time study together with some evening attendance over a period of six or seven years. It may not be possible to offer evening classes in the later year subjects.

Courses in sandwich form after the first year are also available in Civil Engineering and Environmental Engineering.

# Graduate Study Summary of Courses

The Faculty of Applied Science offers research degrees, coursework masters degrees and graduate diplomas. These courses, as well as research and project areas, are all listed under this section but course information is available under the individual sections for each academic unit. The only exception to this is a unique new degree, the Master of Technology Management, which is offered jointly by three faculties, the Faculty of Applied Science, the Faculty of Commerce and Economics and the Faculty of Engineering. Information on the Master of Technology Management **8007** can be found at the end of this section. The Faculty of Applied Science is also involved in the Master of Business Technology program although students enrol through the Faculty of Engineering.

### **Research Degrees**

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. Research degrees may be undertaken in the Faculty of Applied Science as follows:

#### Doctor of Philosophy PhD

| 1000 |
|------|
| 1036 |
| 1010 |
| 1031 |
| 1080 |
| 1016 |
| 1045 |
| 1046 |
| 1050 |
| 1017 |
| 1665 |
| 1060 |
| 1071 |
|      |

# Master of Engineering ME

| Chemical Engineering              | 2150 |
|-----------------------------------|------|
| Materials Science and Engineering | 2175 |
| Mining Engineering                | 2180 |
| Petroleum Engineering             | 2156 |
| Safety Science                    | 2695 |

#### Master of Science MSc

| 2000 |
|------|
| 2036 |
| 2010 |
| 2031 |
| 2040 |
| 2016 |
| 2055 |
| 2046 |
| 2060 |
| 2775 |
| 2070 |
| 2081 |
|      |

### **Coursework Masters Degrees**

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.

Courses of study leading to the award of a Master of Applied Science degree may be undertaken in the Faculty as follows:

#### Master of Applied Science MAppSc

| Engineering Materials                      | 8065      |
|--|-----------|
| Environmental Management                   | 8047.3000 |
| Ergonomics                                 | 8075      |
| Food Technology                            | 8032,1000 |
| Food Microbiology                          | 8032.2000 |
| Food Engineering                           | 8032.3000 |
| Fuel Technology                            | 8060      |
| Biotechnology                              | 8042      |
| Biopharmaceuticals                         | 8043.1000 |
| Biopharmaceuticals (by distance education) | 8043.2000 |
| Corrosion Engineering                      | 8052      |
| Engineering Geology                        | 8022.1000 |
| Geographic Information Systems             | 8027.1000 |
| Geological Data Processing                 | 8022.3000 |
| Groundwater Studies                        | 8022.2000 |
| Industrial Safety                          | 8077      |
| Mining and Mineral Engineering             | 8055      |
| Occupational Health and Safety             | 8044      |
| Process Engineering                        | 8016      |
| Rangeland Management                       | 8025      |
| Remote Sensing                             | 8047.2000 |
|  |           |

#### 8045 Master of Environmental Studies MEnvStud

The Faculty offers a course leading to the award of the degree of Master of Environmental Studies **8045**. 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.

#### 8057

#### Master of Mining Management MMinMgt

The Master of Mining Management **8057** 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.

#### 8671 Master of Safety Science MSafetySc

The Master of Safety Science course **8671** 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.

# **Graduate Diplomas**

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.

Courses of study leading to the award of a graduate diploma may be undertaken in the Faculty of Applied Science as follows:

| Biotechnology                  | 5015      |
|--------------------------------|-----------|
| Ergonomics                     | 5485      |
| Environmental Studies          | 5488      |
| Food Technology                | 5020      |
| Mining and Mineral Engineering | 5040      |
| Mining Management              | 5057      |
| Petroleum Engineering          | 5031      |
| Bangeland Management           | 5031      |
| Remote Sensing                 | 5025      |
| Safety Science                 | 5047.2000 |
| Taxtile Toobhology             | 5480      |
| Maal and Destard Ocianana      | 5090      |
| wool and Pastoral Sciences     | 5081      |

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.

# **Research and Project Areas**

#### School of Applied Bioscience

#### Department of Biotechnology

#### Molecular biology of microbial systems

Construction of improved cellulolytic and ethanol producing strains

Construction of cloning vectors for use in lactic acid bacteria Molecular Biology of selected properties of Lactococci including bacteriophage resistance

Cloning and characterisation of bacterial cellulases

Construction of Zymomonas strains able to ferment alternative carbon sources

Construction of improved cloning vectors for use in Zymomonas

Molecular and genetic analysis of Human Immunodeficiency

Virus isolates

#### Microbial and Cellular Physiology

Environmental optimisation of production of ethanol,

certain antibiotics and certain amino acids, from various microbial systems

Applied and fundamental aspects of the growth of the lactic streptococci; modelling of metabolic processes, energetics and control in lactic streptococci

Optimization of baker's yeast activity and productivity

Optimization of biotransformation processes using multistage continuous culture

Toxin production by Bacillus sp

#### Bioengineering of Process Based Prokaryotic and Eukaryotic Cells

Bioconversion of agricultural resources (cellulose, hemicellulose and starch) component sugars

Design and analysis of reactors for large-scale plant cell and organ culture

Experimental, theoretical and control aspects of bioreactors operating under either batch or continuous conditions

Production, purification and characterization of r-DNA derived glycoproteins

Monoclonal antibody production system

High productivity fermentations using cell recycling Growth and product formation with recombinant mammalian cells

Production of antibodies in plant cell systems Process control and modelling of biological systems

#### **Environmental Biotechnology**

Studies on the mechanisms of mineral biodegradation Optimization of leaching rates of commercially useful minerals

Uptake of metal ions by plants and plant organs Studies of the microbial ecology of leaching heaps Biological removal of heavy metal pollutants Bioremediation studies

Detoxification of Xenobiotic compounds by plant tissues

#### **Department of Food Science and Technology**

#### Food Chemistry and Biochemistry

Physiology and biochemistry of fruit and vegetables; regulation of fruit ripening and senescence; nature, stability and role of pigments in the visual appearance of foods; natural food toxicants; characterisation, biosynthesis and application of the major volatiles of food; composition and properties of herbs and spices; isolation, characterisation and functional properties of protein from novel food and feed sources; structure, composition, moisture binding capacity, properties and behaviour of starches and their derivatives; chemistry and technology of fats and oils; chemistry and biochemistry of deteriorative reactions in foods; technology and processing of cereals and cereal components.

#### Food Microbiology

Microbial quality assurance; methods for the microbiological examination of foods. Microorganisms of public health significance; foodborne microbial disease. Microbial ecology and biochemistry of food spoilage. Microbial ecology and biochemistry of fermented foods and beverages. Yeast ecology of foods; biochemistry of yeast growth and autolysis. Microorganisms as sources of food ingredients and processing aids; food biotechnology.

#### Food Acceptability and Sensory Analysis

Basic studies of food acceptability; the development of new techniques for sensory analysis and product development strategies; cross cultural comparison of food preferences.

#### **Food Processing**

Production and stability of intermediate moisture foods; dehydration and quality of fruits, vegetables, nuts, legumes and seafoods; production and stability of traditional south-east Asian foods; utilisation of marine organisms in new food products, high quality seafood product technology; processed meat technology; utilisation of food process waste materials.

#### Food Engineering

Grain storage and drying; evaporation; baking. Food thermal, physical and rheological properties. Simulation of food process operations. Computer control of food processing

#### Nutrition

Nutrient composition of foods; effect of processing on nutrients in foods; food and nutrition policy; nutrition through the life cycle; food composition data bases; food habits; factors affecting salt consumption; dietary intervention strategies; assessment of nutritional status; food factors and cancer; community nutrition. Nutrients from unconventional plant food sources.

#### School of Chemical Engineering and Industrial Chemistry

### Industrial Chemistry

Chemical reaction engineering, catalysis and synthetic fuel production and processing; petrochemistry; conversion processes of coal to oil; catalytic methods and reactors; catalytic methods for air pollution control; kinetic modelling of catalytic processes; catalyst activation and de-activation studies; car exhaust catalysts

Solid state, molten salt and aqueous electrochemistry; electrochemistry of glass and chemistry of glass melting; physical and chemical characterisation of glasses

Metal electrowining; battery research, vanadium redox cell development. Electrode kinetics and mechanistic studies. Aluminium electrolysis; electrolytic decomposition of organochlorines. Conducting polymer electrodes evaluation and development of solid state gas sensors

Environmental chemistry; Analysis of industrial pollutants; air and water pollution monitoring; chemical strategies for emission control; occupational health chemistry; development of new analytical methods for process control and environmental monitoring; environmental catalysis; air pollution control

#### **Polymer Science**

Preparative and analytical polymer chemistry Membrane preparation and properties Polybutadiene polymerization by Ziegler-Natta catalysts, molecular weight properties Elastomer filler applications in rubber and plastics Thermal analysis of elastomer and plastics Interpenetrating polymer networks, fracture toughness of polymercomposites and thermoplastics

Conducting polymers; polymer fractals; radiation grafting and crosslinking, conducting polymer membranes Structure-Property relationships of optical polymers Free-radical polymerisation kinetics Hydrogels and Biomaterials Rigid-rigid polymer blends Conducting polymer composites Rheology of polymeric systems

### **Chemical Engineering**

Particle dynamics; fluidisation and spouted bed processesdrying, carbonization, devolatization and gasification; sedimentation and thickening; filtration mechanisms, dewatering of filter cakes, effects of surfactants; characterisation of particulate materials; aggregation kinetic modelling; electrostatic charge determination; Non-Newtonian fluid-particle systems

Mass transfer; packed tower hydraulics and mass transfer performance; hydrodynamics of sieve tray and related mass transfer contractors; mass transfer in bubble columns Refrigeration

**Reaction engineering**, mass transfer with chemical reaction in heterogeneous systems; effect of mixing and nonideal transport; complex consecutive reactions, catalytic reaction engineering, pressure reactors; mathematical modelling

#### Membrane Reactor Applications

Aqueous processes, thermodynamics and kinetics in aqueous solutions; dissolution and precipitation kinetics; mineral processes and nuclear materials processes

Membrane processes, membrane fabrication for ultrafiltration and reverse osmosis; membrane characterisation; ultrafiltration of proteinaceous solutions; desalination of brackish water; ion separation; pervaporation, membrane distillation; gas fractionation, cross flow filtration; liquid membranes; membrane bioreactors; environmental applications; dynamic membranes; ceramic membranes; hydrogel coatings

**Pollution studies,** unit operations in water pollution control, biological treatment methods, advance treatment methods; unit operations in air pollution control; bio-filtration, odour control processes; fabric filtration monitoring; hot gas cleaning

**Process design and control,** computer aided design; systems analysis and process identification; plant simulation; strategies for fault analysis; process optimization studies

Separations science; development and evaluation of new methods for solid-liquid, liquid-liquid and gas-gas separations

**Energy conservation and waste minimisation**; improved design procedures for heat exchange networks; mass exchange networks for waste minimisation

#### Supercritical Fluid Technology

**Hydrometallurgy**; minerals dissolution and leaching processes; liquor purification processes, metal recovery by precipitation, adsorption, ion-exchange, cementation and electrolytic processes, dewatering of minerals

**Refrigeration**, heat transfer and food engineering; neural networks; genetic algorithms and other optimization methods; computational fluid dynamics; phase change and inverse heat transfer; food refrigeration

### Fuel technology fuel science and engineering

Fuel processing; chemical and physical properties of chars; pyrolysis of coal and composition of the volatile products; fluidised bed gasification; thermochemistry of gas-solid reactions in fluidised beds; thermogravimetric analysis of chars; kinetics of carbon gasification; lubricating oil and bitumen from oil shale

**Combustion;** fluidised bed combustion; flames, burners and flame stability; oil-coal suspensions; incinerator design for gaseous liquid and solid wastes; industrial applications of natural gas; furnace modelling; High efficiency natural gas burners; low emission gas burners

Fuel efficiency; studies on fuel efficiency systems; energy and resource recovery from wastes; efficiency of fuel conversion processes

**Fuel constitution**; analysis, constitution and characterisation of primary and derived fuels

Air pollution; workplace atmospheres; combustion generated pollutants gaseous and particulate

Solid wastes; pyrolysis of waste material; resource recovery; energy analysis; incineration

### School of Fibre Science and Technology

### Department of Textile Technology

#### Fabric Manufacture

Structural mechanics of fibre assemblies, including finite element methods. Properties and performance requirements of industrial/technical fabrics, including composite preforms. Computer aided engineering of textile structures, including aesthetic and functional design. Computer simulation of textile and garment production.

#### Fibre Processing and Fabric Manufacture

Fibre processing and Yarn Manufacturing Fibre/fibre and fibre/pin interactions during processing. Mechanical damage of wool fibres in processing

#### **Textile Chemistry**

Transfer printing of cotton. Dyeing of jute/cotton blends. Dielectric fixation of dyes onto fibres. Selective dark fibre bleaching of cashmere. Environmentally sound methods of shrinkproofing wool.

#### Dyeing and finishing of textiles

Low chrome dyeing of wool. Forensic examination of dyes fibres. Textile severance morphology. Sun protection from textiles. Biological damage to cotton. Antistatic finishes. Microstructurally modified hydrogels. Eliminating metals from dyehouse effluent. Colour theory for the blending of pre-dyed fibres.

#### Textile Engineering

Econometrics of the textile and clothing industries. Wool scouring, carbonising and drying technology. Effluent

treatment. Waste residue recovery. Dehairing and processing of cashmere.

#### **Textile Physics**

Structure-property relationships for fibres, yarns, fabrics and apparel products. Non-linear bending, buckling and draping behaviour. Fibre and structural non-uniformities in textile materials. Definition, measurement and specification of fabric low stress mechanical and surface properties. Physical equilibration and ageing of textile materials. Fibre non-linear viscoelasticity and fabric recovery from deformation. Heat and mass transfer through fibrous structures. Optimisation of quality of wool textile materials. Mechanisms and test methods for fabric wrinkle recovery. Dynamic mechanical properties of textile materials. Fragmentation effect in textile yarns and composite materials.

#### **Department of Wool and Animal Science**

#### **Wool Metrology**

Modelling wool production and processing Developing wool metrology methods Wool marketing Wool quality and sheep breeding and nutrition

#### **Animal Genetics**

Quantitative genetics Design and analysis of sire evaluation systems Design and analysis of crossbreeding experiments Design of selection programs Analysis of selection experiments Estimation of genetic barameters

#### **Animal Production**

Factors affecting wool growth Sheep production and grazing behaviour in arid areas Sheep reproduction

#### Agronomy and Range Management

Dynamics of pasture ecosystems Competition between pasture species Modelling of chenopod shrublands Ecology of shrub encroachment Utilisation of pasture by sheep and goats

#### Animal Growth and Development

Growth and development Carcass composition

#### **Animal Nutrition**

Ruminant nutrition Pasture utilisation Efficiency of wool growth Grazing management Carpet wool production

#### **Wool Processing**

Fibre breakage mechanisms in early stage processing The effect of wool properties on wool performance Wool photochemistry The effect of technology in distance education

#### School of Geography

Land Resources and Land Degradation Landforms and soils in drainage basins Hill slope processes Soil studies, including soil survey, soil-plant relations, soil chemistry, soil hydrology Hazard analysis using remote sensing Biogeography, particularly plant distributions, environmental controls and disturbances of plant and animal habitats Development of alluvial landscapes Forest resource inventory and geographic aspects of conservation Disturbance ecology Acid sulphate soil development and management Gully erosion Fluvial geomorphology and river channel change Avulsions and anastamosing streams River management and flow regulation Water quality impacts on ecology and fish diseases

#### Geoprocessing and Information Systems

Remote sensing in environmental studies and land evaluation Automated cartography Land cover analysis using remote sensing Terrain classification, resource inventory systems Geographic information systems Information systems for mapping socio-economic and physical resources Digital elevation modelling Multi-media geographic information systems Radar modelling and estimation of biomass EIS and Expert Systems for regional planning

#### Social and Economic Processes

Rural transport problems Transportation and land use analysis Travel demand forecasting and modelling Transportation planning and policy analysis Social aspects of interaction and transportation Residential choice processes

Migration and ethnic studies Medical geography and spatial epidemiology Problems of non-metropolitan regions Regional policy, planning and locational analysis Recreational resource management Tourism development and impacts Social impact assessment Cultural geography, spacial construction of communities and place Location of public and private facilities Cancer morbidity and mortality Rural demographic change Agricultural economics and management Population studies: migration and settlement studies Urban and regional development Locational analysis

#### **Environmental Change**

Human impacts on environments of south eastern Australia Quaternary vegetation change and environments Residential development patterns and processes Structure, growth and change in large cities Population, geography, demographic analysis, social indicators, migration and population forecasting Labour markets and job mobility Socioeconomic impacts, evaluation and analysis of urban and regional development projects Socioeconomic impacts and natural hazards Palynological analysis of vegetation Role of people and fire in vegetation dynamics

#### School of Materials Science and Engineering

Structure-property relationship in polymers Polymer-,metal-,and ceramic-matrix composites Deformation and failure of polymers and toughened plastics Failure micromechanisms in composite materials In-situ experimentation in the SEM

Biomaterials. New composites

Aerospace materials Metal-and polymer-matrix composites Aluminium-lithium alloys Nickel-based superalloys Adhesive bonding Fatigue, creep, and failure of metals.

Structure-property relations in materials Phase equilibria and thermodynamics of metals Corrosion and oxidation of materials Diffusion processes Microstructural evolution in metals Intermetallic compounds Advanced coatings for corrosion resistance

Fracture and fatigue of metals and metal-matrix composites Sustained-load cracking of aluminium alloys High-temperature fracture toughness of metals Mixed-mode fracture mechanics Finite element analysis Stress analysis of welded joints Computer modelling of crack growth in metals Prediction of residual stress in metals

Microstructure-property relations in metals High-strength low-alloy steels Weld heat-affected zone toughness of metals Microstructural control of metals

Abrasive wear of metals and metal-matrix composites Intermetallic phases in aluminium alloys

Thermodynamics of metallic and slag melts Thermodynamics and kinetics of pyrometallurgical processes

Processes of reduction of iron, manganese, chromium and other metals

New technologies for iron-making and ferroalloy-making BOS and EAF steel-making

Sulfur and phosphorus in iron and steel and processes of steel desulfurization and dephosphorization

Structure-property relations of ceramics Powder processing, forming, and sintering of ceramics Wear resistance of ceramics Refractories and refractory coatings Clay-and porcelain-based bodies

New Direct Ironmaking technology: The HIsmeltR Process Gas based direct reduction of iron ore (DR I) New developments in blast furnace ironmaking (Pulverised coal injection)

Electric arc furnace (EAF) steelmaking

Ferrous and non-ferrous foundry processes Kinetics and liquid/solid/gas reactions in metallurgical processes Phase equilibria of ceramic systems Non-oxide ceramic processing and properties Bioceramics High-temperature superconductors Powder processing, densification, and crystal growth of ceramics Glass and glass-ceramics

Ceramic-matrix composites Microwave processing of ceramics Gemstones Electrophoresis of ceramics

Optimisation of metallurgical processes using computer modelling Selective precipitation and dissolution of minerals Selective flotation of minerals Aqueous-bubble-particle interactions Bubble-metal-slag interactions

Materials degradation at high temperatures Reaction of metals with liquid and gases at high temperatures Diffusional processes in high-temperature metals oxidation Carburisation and sulfidation reactions Coatings and alloys for high-temperature service Corrosion of glass and ceramics Dealloying reactions

Particle packing characteristics Particle characterisation and data interpretation Relationship between micro- and macro-structural properties of particle packings Raw materials processing

Fluid flow, heat and mass transfer in packed beds Metallurgical process modelling Blast furnace ironmaking and new ironmaking technology

Fabrication of high-temperature superconducting bulk materials and wires

Fundamental properties of high temperature super-conductors

Electronic and magnetic properties of materials Functional electronic ceramics

Nonlinear phenomena in materials and dynamic systems

#### School of Mines

#### **Department of Applied Geology**

Environmental Geology: Use of benthic foraminifera (Protozoa) in coastal environmental assessements and in monitoring programs; statistical evaluation of marine sediments as indicators of the behaviour of water masses; geochemistry of recent sediments and its impact on the benthic fauna; management of coastal regions and the estuarine environment.

Volcanology: Silicic volcanism in the Hunter Valley, intraplate volcanism in Bathurst, NSW and Rarotonga, Cook Islands; volcanic hazards in New Zealand; Geoscience education.

**Geochemistry:** Development of synthetic geochemical standards using organo-silicate coprecipitation methods and assessment of the application of these standards for a

range of sample processing and analytical techniques; exploration geochemical methods (including the use of lags) in the semi-arid to arid environments of eastern Australia; geostatistical analysis of base metal distributions within volcanogenic massive sulphide deposits; methods for conducting baseline contaminant surveys in urban areas and statistical interpretation of results.

Exploration Geochemistry: Metal dispersion from gossans in the Lachlan Fold Belt.

**Petrology:** Metamorphism and geochronology of granulite terranes in Antarctica and central and western Australia; development of quantitative constraints on models for Proterozoic tectonism and lower crustal evolution; experimental studies of biotite stability and melting behaviour at high temperature.

Hydrogeology: Hydrochemistry of surface water and ground water in the Botany sands aquifer, Botany Basin; dryland salinity processes in the southern Tablelands (Yass area), Liverpool Plains, and Wagga Wagga area; mixing of shallow and deep ground waters as a process of salinisation dryland salinity catchments; water rock interaction, hydrogeological and hydrochemical processes in the Palaeozoic fractured bedrock aquifers of south-east Australia.

**Geotectonics:** Precambrian assembly and breakup of Gondwanaland, using models based on similar fragments operative in the opening of the Atlantic Ocean, such as the Iberian Massif, as compared to Sri Lanka, together with present day rifting along the Red Sea Dead Sea system.

Structural Geology: Geology of the Hastings Terrane between Taree and Kempsey, including the local geology of this frament of displaced crust, the nature of faulting/serpentinites around its borders and the nature of the joint systems in the northern Hastings Terrane; structure of the Texas megafold in the border area between NSW and Queensland, to verify the megafolded accretion-subduction tectonic model previously advanced for this region; relationship between granites and regional deformation in the northern Lachlan Fold Belt near Bathurst.

**Engineering Geology:** Engineering geology of surficial deposits; coal mining geomechanics and environmental geological aspects of coal mining, especially the effects of shallow mining; soil and rock construction materials, including the use of sandstone in thin veneer panels.

**Geophysics:** High resolution seismic methods for coal and base metal mining; seismic anisotropy; seismic refraction methods.

Igneous Petrology: Form, emplacement and geochemistry of igneous dykes with particular reference to the Sydney Basin and the Falkland Islands; geochemistry of Iava flows in the Blue Mountains. Environmental Geochemistry: Marine sediment in the Hawkesbury River estuaries, Lake Macquarie and the Lagoon of Venice, Italy; processing of environmental geochemical data.

**Stratigraphy:** Use of uranium-lead isotopic ages of zircons determined by the SHRIMP ion microprobe technique to calibrate the relative geological time scale for the Ordovician to Permian Periods of the Palaeozoic Era

Geological Remote Sensing: Use of remotely-sensed imagery for geological exploration and environmental monitoring; stratigraphic mapping with airbone scanners; lineament and tectonic analysis; image processing software development; integration of geological databases, airborne and spaceborne radar data. Geological Education: Development of computer aided learning for training in geological data processing and mining management.

**Coal Geology:** Nature, origin and significance of mineral matter in coal; processes related to frictional ignition of methane from Australian coal mine rocks; geology of Sydney Basin Coalfields. Sedimentology: Triassic deposition in the Sydney, Gunnedah & Bowen Basins; Sedimentary Petrology: Quantitative mineralogical analysis of sedimentary materials; sandstone provenance and diagenesis.

#### **Mining Engineering**

Subsidence of strata overlying underground coal workings and related damage effects; development of a "Generalised Empirical Method" for subsidence prediction, enabling the empirical data from one coalfield to be employed for predictions elsewhere, after appropriate modifications through the use of a parameter reflecting the lithological character of the undermined strata; comparison of the efficiencies of different ground sealing materials in containing leachates from land fill disposal of various wastes.

Application of computing to mining engineering, operations research and computer simulation of processes; mine safety including lighting, ergonomics in mining, vibration and jarring of machine operators; general occupational health and safety; attitudes to safety; windblasts in underground coal mines due to roof falls.

Improving safety and strata control in coal mining, including both field performance of local mine designs to establish mechanisms of behaviour and development of the theoretical knowledge base to address these mechanisms in design; avoidance of sudden uncontrolled collapses of strata in underground coal mines; minimising the hazards from windblasts in coal mines arising from the "piston effect" of massive strata collapses; use of electrostatically charged water sprays to suppress respirable dust at the coal face; impact breakage of rock.

Mining management, motivating and managing change in the future; management structures for a changing environment; application of TQM techniques in lieu of statutory regulation.

Instrumentation development for frictional ignition and rock cuttability testing; exploration and mining of gemstone deposits.

Minerals engineering, especially coal: residence times and kinetics in flotation; image analysis of coal sections; mathematical modelling of fluid flow in coal distributors.

Mining explosives: the effect of stemming confinement on fragmentation and movement in blasting, including investigation of the size of the stemming material on the effect of blasting efficiency and of fragmentation size and the explosive cavity for the same blasthole diameter to stemming size ratio; design and use of linear shaped charges to form radial cracks along a predetermined line; depth penetration in the target material.

Air leakage in ventilation ducting; compressive strength of mine pillars; failure criteria for rock and rock mass; role of chemical solutions in rock fracturing; role of tensioning in rock bolting.

Geomechanics: boundary element methods for the computation of stress near underground openings; boundary element methods for the prediction of crack propagation in rock, as applied in rock cutting technology, blasting technology and hydro fracturing; finite element methods for the analysis of wind blast in underground coal mines due to goaf collapse.

#### **Petroleum Engineering**

#### Improved Oil and Gas Recovery

Basic studies of the physical mechanisms responsible for three-phase flow on the pore-scale.

Network modelling of multi-phase flow and oil recovery in porous media.

The effects of wettability and spreading coefficients in the recovery of waterflood residual oil by gas flooding.

# Drilling, Wellbore Engineering and Formation Damage

Studies of the effects of change in permeability due to physico-chemical interactions on mud pressure penetration.

Demonstration of the mud pressure penetration concept with borehole collapse tests.

Development of a mechanistic description of the swelling characteristics and/or generation of hydrational stress of shales.

Development of a mathematical model describing the stresses, side forces on the pipe and bit tilt angle involved in the process of drilling a well.

Development of design criteria for selecting and optimising BHA configurations.

Development of a field method of terminating bit walk tendency due to bit-rock interaction.

Effect of fluid composition, salinity and temperature on the porosity of the filter cake.

Effect of mud filtiate composition and fluid flow rate on formation damage.

#### Gas Recovery from Low Permeability Reservoirs Reservoir Characterisations

Petrophysical evaluation of lithologically complex reservoirs.

Generation of algorithms to determine porosity, permeability and fluid saturations in lithologically complex reservoirs.

Principal Component Analysis, Pattern Recognition, Electrofacies, Hydraulic Seal Units, Neural Networking, Fuzzy Logic.

Low Resistivity pay sands.

Thin-bed problems.

Identification and quantification of coal bed methane from well logs.

Identification of ore bodies from well logs.

#### **Safety Science**

#### **Biomechanics**

Analysis of human gait on flat and inclined surfaces. Impact and trauma biomechanics Slips and falls.

#### Ergonomics

Posture analysis and workstation design. Manual handling. Back injury and whole body vibration.

#### Human-Computer Interaction

Usability of computer based technology and consumer products. Design and rapid prototyping of interfaces to products & equipment.

#### Chemical Safety & Applied Toxicology

New approaches to toxicity screening and testing using molecular and cellular biology Management of hazardous chemicals in the workplace. Chemicals and environmental health. New methods for screening the toxicity of natural products.

#### **Risk Assessment and Management**

Risk evaluation in industry. Effect of electric and magnetic fields on the body. Behavioural and other aspects of accidents. Accident analysis, reporting and management.

# 8007 Master of Technology Management MTM

The Master of Technology Management degree is a new multidisciplinary course approved by the UNSW Council in June 1996. The three faculties who have initiated this unique joint enterprise are the Faculties of Applied Science, Commerce and Economics, and Engineering.

The course is built on the acknowledged strengths of these faculties in applied science, commerce and economics, engineering, technology and technology management.

The major strength of the course is its flexibility. It is designed not only for the recent graduate but also for students who have some years experience in industry and

have discovered the areas where their initial education needs strengthening to progress their career. This course provides a mechanism for such people to select from a broad range of subjects and choose those that are most suited to their own industry and their own career path.

Further information the course is available from the MTM Office in the Faculty of Applied Science, contact Mrs Idelies Govett, Tel: (02) 93855563, Fax: (02) 93855456, Email: i.govett@UNSW.EDU.AU
A candidate for the MTM degree should have either a four year bachelor's degree or a three year degree plus either another qualification at an acceptable level, or other academic or professional attainments (including relevant work experience). An applicant who submits evidence of such other academic and professional qualifications as may be approved by the MTM Course Committee may be permitted to enrol in the degree.

Subjects in the MTM course are in four categories and the overall course is structured around the maximum and minimum numbers of subjects that can be drawn from each. The range of choice within the categories is wide and, within the overall structure, students are provided with the opportunity to construct a course best suited to their background and professional needs.

Candidates are required to complete a program of 10 subjects selected from the list of subjects approved for the MTM, consistent with the overall requirements for:

(a) a minimum of 2 and a maximum of 4 subjects from Category A (commercial and business studies) subjects,

(b) a minimum of 2 and a maximum of 4 subjects from Category B (technology management) subjects,

(c) a minimum of 2 and a maximum of 4 subjects from Category C (technical broadening) subjects, and/or Category D (specialist) subjects.

Before enrolment an applicant shall submit an intended program for approval to ensure that the program is suitably focussed, and, the applicant's academic background is adequate for all chosen subjects.

The maximum period of enrolment shall be 2 academic sessions for a full time candidate and 4 academic sessions for a part time candidate.

The Master of Technology Management is a full fee paying course. There are differences in the fee schedules for permanent residents and citizens of Australia and for international students. These fees are set annually.

### **Category A: Commercial and Business Studies**

The MTM course provides for a minimum of two and a maximum of four subjects from this group. Subjects are available in the following disciplinary streams. Prerequisites and proscriptions may apply to these subjects depending on the prior knowledge of the student. It is the responsibility of the student to satisfy these conditions or to negotiate exemptions.

### Accounting and Financial Management

| ACCT5901 | Accounting: A User Perspective             |
|----------|--|
| ACCT5915 | Individual Judgement and Choice            |
| ACCT5931 | Strategic Management Accounting            |
| ACCT5932 | Public Sector Accounting and Financial     |
|          | Reporting                                  |
| ACCT5956 | Management Planning and Control            |
| ACCT5996 | Management Accounting Control Systems      |
| CIVL8701 | Financial Management                       |
| CIVL8714 | Resource Management                        |
| COMP9174 | Advanced Decision Theory                   |
| FINS5511 | Corporate Finance                          |
| FINS5512 | Australian Capital Markets                 |
| FINS5513 | Security Valuation and Portfolio Selection |

| Business Economics<br>Business Forecasting<br>Public Enterprise Economics and<br>Cost-Benefit Analysis |  |
|--|--|
| ations   |  |
| Australian Industrial Relations  |  |
| Employment and Industrial Law  |  |
| International and Comparative Industrial Relations   |  |
| Wage Determination   |  |
| Industrial Relations Processes   |  |
| Public Policy and Employment   |  |
| Organisational Management  |  |
| Strategic Management: Systems and<br>Processes   |  |
| Managerial Dynamics  |  |
| Quality and Quality Systems  |  |
| Social and Organisational Analysis   |  |
| Organisational Behaviour   |  |
| Organisational Change and Development  |  |
| Corporate, Managerial and Union Strategy   |  |
| International Dimensions of Organisational<br>Behaviour  |  |
| Organisational Power and Politics  |  |
| Organisational Communications  |  |
| Human Potentialities   |  |
| Men and Women in Organisations   |  |
| Management in Cross Cultural Contexts  |  |
| Performance Management   |  |
|  |  |

#### Human Resource Management

| CIVL8706 Human Resources Management          |    |
|--|----|
| GEOG9230 Population, Health and Environment  |    |
| IBOB5906 Human Resource Management in Contex | Ł  |
| IBOB5907 Human Resources Management Process  | es |
| IBOB5948 Human Resources Development         |    |

#### Information Systems

| INFS5957 | Information and Decision Technology |
|----------|-------------------------------------|
| INFS5989 | Information Systems Design          |
| INFS5988 | Business Information Systems        |
| INFS5991 | Decision Support Systems            |

#### Legal Studies

Economico

| CIVL8707  | Contracts Management                     |
|-----------|--|
| CIVL8726  | Legal Studies and Professional Practice  |
| LEGT5511  | Legal Foundations of Business            |
| LEGT5531  | Legal Regulations for Business           |
| LEGT5541  | Company Law                              |
| LEGT5551  | Revenue Law                              |
| LEGT5560  | Legal Aspects of Business Strategy       |
| LEGT5561  | Legal Aspects of Finance                 |
| LEGT5562  | Legal Aspects of International Business  |
| LEGT5571  | Franchising and Alternative Distribution |
|           | Systems                                  |
| SAFE9232  | Introduction to Occupational Health and  |
|           | Safety Law                               |
| SAFE9273  | Environment and Law                      |
| Marketing |  |
| MARK5902  | Elements of Marketing                    |
| MARK5903  | International Marketing                  |
| MARK5929  | Corporate and Marketing Planning         |
|           | and Policy                               |
| MARK5930  | Managerial Elements of Marketing         |

### **Category B: Technology Management**

The MTM course provides for a minimum of two and a maximum of four subjects from this group. The subjects are designed to deal with the application of management concepts in specific technical settings. A list of available subjects is given below.

#### Environmental Technologies

| CIVL9872 | Solid Waste Management                 |
|----------|--|
| CIVL9881 | Hazardous Waste Management             |
| CIVL8872 | Solid Waste Management                 |
| CIVL8881 | Hazardous Waste Management             |
| FUEL5880 | Unit Operations in Wastewater          |
|          | Sludge, and Solids Management          |
| GEOG9042 | Environmental Impact Assessment        |
| GEOG9130 | Soil Studies for Arid Lands Management |
| GEOG9150 | Remote Sensing Applications            |
| GEOG9240 | Principles of Geographic               |
|          | Information Systems                    |
| GEOG9290 | Image Analysis of Remote Sensing       |
| GEOG9300 | Vegetation Management                  |
| GEOG9310 | River Management                       |
| GEOG9320 | Soil Degradation and Conservation      |
| SAFE9271 | Environmental Planning and Assessment  |
| SAFE9274 | Environmental Management Systems       |
|          |  |

#### Information Technologies

| Software Engineering                    |
|---|
| Computer Mapping and Display            |
| Application and Management of           |
| Geographical Information Systems        |
| Spatial Data Processing and Integration |
| Transportation Applications of          |
| Geographical Information Systems        |
| Information Systems Project Management  |
| Software Engineering Management         |
| Information Systems Management          |
| Data Management                         |
|   |

#### **Project Management**

| BIOM9410 | Regulatory Requirements                 |
|----------|---|
|          | of Biomedical Technology                |
| CIVL8731 | Project Management Framework            |
| CIVL8702 | Project Time Management                 |
| CIVL8710 | Management of Risk                      |
| IROB5946 | Managing Occupational Health and Safety |
| MANF9400 | Industrial Management                   |
| MANF9410 | Total Quality Management                |
| MANF9470 | Production Management 1                 |
| MANF9601 | Economic Decisions in                   |
|          | Industrial Management                   |

#### Mining and Extractive Technologies

KCME4203 Mine Management KCME4204 Mineral Exploration Project Management

#### Safety Managementt

| SAFE9211 Introduction to Safety Enginee  | rina     |
|--|----------|
| SAFE9224 Principles of Ergonomics        | 5        |
| SAFE9353 Major Hazards Management        |          |
| SAFE9242 Effective Behaviour in Organis  | ations   |
| SAFE9343 Innovation, Productivity and Sa | afetv    |
| SAFE9350 Risk Management                 |          |
| SAFE9543 Management of Dangerous Ma      | aterials |

### **Category C: Technical Broadening**

The MTM course provides for a minimum total of two and a maximum total of four subjects chosen from this group and group D below.

The 'technical broadening' subjects are intended to provide the graduate engineer or technologist with an introduction to a subject area that he/she may not have studied in the undergraduate course but which has now become professionally important or whose technological basis has only recently developed. It does not follow that because the treatment is 'introductory' that it is also 'elementary.' These subjects are generally offered by the Faculties of Applied Science or Engineering and are listed below. Both Faculties intend to increase the number of subjects in this group, in some cases using resource-based learning approaches.

#### **Biomedical Engineering**

| BIOM9027 | Biomedical Imaging                    |
|----------|---------------------------------------|
| BIOM9028 | Radiation Physics                     |
| BIOM9060 | Biomedical Systems Analysis           |
| BIOM9321 | Physiological Fluid Mechanics         |
| BIOM9331 | Mass Transfer in Medicine             |
| BIOM9332 | Biocompatibility                      |
| BIOM9430 | Biomedical Standards                  |
| BIOM9510 | Introductory Biomechanics             |
| BIOM9541 | Mechanics of the Human Body           |
| BIOM9621 | Biological Systems Analysis           |
| BIOM9701 | Dynamics of the Cardiovascular System |
|          |                                       |

#### Biotechnology

| Environmental Biotechnology    |
|--------------------------------|
| Biological Principles          |
| Bioengineering Principles      |
| Applied Genetics               |
| Peptide and Protein Technology |
| Biochemical Engineering        |
| Applied Cellular Physiology    |
|                                |

### **Chemical Engineering and Industrial Chemistry**

| CEIC5342 | Energy Management in the        |
|----------|---------------------------------|
|          | Process Industries              |
| CEIC5340 | Polymer Synthesis: Fundamentals |
|          | and Techniques                  |
| CEIC5330 | Process Engineering and         |
|          | the Petroleum Industry          |
| CEIC5336 | Environmental Chemistry         |
|          | in the Process Industries       |
| CEIC5337 | Particle Characterisation       |
|          | in the Process Industries       |

### Fibre Science and Technology

TEXT5601 Colour Science

### Food Science and Technoogy

FOOD1450 Food Processing Wastes

### Geography

GEOG9150 Remote Sensing Applications

#### Geology

| GEOL9010 | Groundwater Environments |
|----------|--------------------------|
| GEOL9060 | Environmental Geology    |

#### Information Systems

INFS5983 Business Data Communications

#### Materials Science and Engineering

| IDES5051 | Plastics, Materials and Processes  |
|----------|------------------------------------|
| MATS6535 | Industrial Coatings for            |
|          | Corrosion Protection               |
| MATS7480 | Polymer Product Design             |
| MATS7470 | Polymer Processing and Fabrication |
| MATS9520 | Engineering Materials              |
| MATS9530 | Materials Engineering              |
| Mines    |                                    |
| MINE0130 | Principles of Mining               |
|          |                                    |

#### Safety Science

| SAFE9211 | Introduction to Safety Engineering  |
|----------|-------------------------------------|
| SAFE9260 | Introduction to Occupational Health |
| SAFE9261 | Occupational Hygiene                |
| SAFE9262 | Occupational Medicine               |
| SAFE9265 | Occupational Health Practice        |
| SAFE9272 | Environment and Medicine            |
| SAFE9352 | Hazard and Risk Analysis            |
| SAFE9424 | Applied Ergonomics                  |
| SAFE9426 | Ergonomics and New Technology       |
|          |                                     |

### **Category D: Specialist Subjects**

The MTM course provides for a minimum total of two and a maximum total of four subjects chosen from this group and group C above. These are the specialist technical subjects which make up the postgraduate coursework programs in the Faculties of Applied Science and Engineering. They are advanced treatments of the subject matter that go beyond the content or level of the usual undergraduate course.

Almost all graduate subjects from the Faculty of Applied Science and the Faculty of Engineering are available, many in highly technical and specialised areas. 32 APPLIED SCIENCE

# **School of Applied Bioscience**

Head of School Professor PP Gray

### Administrative Officer

Ms R Lee

The School of Applied Bioscience was formed in 1986 and consists of the Departments of Biotechnology and of Food Science and Technology. Previously these disciplines were separate Schools in the Faculties of Biological Sciences and Applied Science, respectively. The Department of Biotechnology retains membership of the Faculty of Biological and Behavioural Sciences. The academic relationship between biotechnology and food science and technology at UNSW is unique in Australia and offers opportunities for joint activities to further develop the food, beverage and pharmaceutical industries in this country.

Specialised centres exist in and are associated with each Department, and include the Bioengineering Centre, the Cooperative Research Centre for Biopharmaceutical Research and the Cooperative Research Centre for Food Industry Innovation.

The School offers four undergraduate degrees and seven formal coursework postgraduate degrees or diplomas, as well as postgraduate MSc and PhD research degrees.

Graduates of the School are keenly sought by industry and government employers. A number of Co-op Program, government and industry scholarships are available on a competitive basis for undergraduate and postgraduate studies.

The food and biotechnology industries have been targeted by government as key sectors for expansion with particular reference to exports and import replacement.

# **Department of Biotechnology**

### Head of Department

Professor PP Gray

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.

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.

# **Undergraduate Study**

### **Course Outlines**

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 and 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.

### 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.

|                |                              | HF<br>S1 | W<br>S2 | СР |
|----------------|------------------------------|----------|---------|----|
| Vear 1         |                              | 91       | 52      |    |
| BIOS1101       | Evolutionary and Eurotional  |          |         |    |
| Biodrivi       | Biology                      | 6        | 0       | 15 |
| BIOS1201       | Molecules, Cells and Genes   | ñ        | 6       | 15 |
| CHEM1101       | Chemistry 1A and             | ě        | õ       | 15 |
| CHEM1201       | Chemistry 1B                 | õ        | 6       | 15 |
| MATH1131       | Mathematics 1A or            | •        | •       |    |
| MATH1141       | Higher Mathematics 1A or     |          |         |    |
| MATH1011       | General Mathematics 1B       | 6        | 0       | 15 |
| MATH1231       | Mathematics 1B or            |          | -       |    |
| MATH1241       | Higher Mathematics 1B or     |          |         |    |
| MATH1021       | General Mathematics 1C       | 0        | 6       | 15 |
|                | and an additional 2          |          |         |    |
|                | level 1 subjects: recommende | ed       |         |    |
| PHYS1002       | Physics 1 or                 |          |         |    |
| PHYS1022       | Introductory Physics 1 or    |          |         |    |
| CHEN1020       | Engineering 1CE              | 6        | 6       | 30 |
| Total HPW Se   | ssion 1 24                   |          |         |    |
| Total HPW Se   | ssion 2 24                   |          |         |    |
| Total Credit P | oints 120                    |          |         |    |

|                     |                                  | HP<br>S1  | W<br>S2   | СР   |
|---------------------|----------------------------------|-----------|-----------|------|
| Year 2              | Distant Chinaka and American     | ~         | ~         | 46   |
| BIOC2101            | Principles of Biochemistry       | 0         | 0<br>e    | 15   |
| BIOC2201            | Functioners of Molecular Biology | 0         | 0         | 15   |
| BI052011            | Physiological Ecology            | 6         | 0         | 15   |
| BIO 52021           | Introductory Genetics            | ň         | 6         | 15   |
| MICB2021            | Microbiology                     | õ         | õ         | 15   |
| MICR2201            | Introductory Microbiology        | 6         | õ         | 15   |
| CHEM2021            | Organic Chemistry or             | 6         | 0         | 15   |
| CHEM2041            | Chemical and Spectroscopic       |           |           |      |
|                     | Analysis                         | 0         | 6         | 15   |
| plus one Level      | ll unit                          | 0         | 6         | 15   |
| General Educa       | ation Subject(s)                 | 2         | 2         | 15   |
| Total HPW Se        | ssion 1 26                       |           |           |      |
| <b>Total HPW Se</b> | ssion 2 26                       |           |           |      |
| Total Credit P      | oints 135                        |           |           |      |
| Voor 2              |                                  |           |           |      |
| BIOC3121            | Molecular Biology of             |           |           |      |
| DIOCOTZI            | Nucleic Acids                    | 6         | 0         | 15   |
| BIOC3281            | Recombinant-DNA                  |           |           |      |
|                     | Techniques and Eukaryotic        |           |           |      |
|                     | Molecular Biology                | 0         | 6         | 15   |
| BIOT3011            | Biotechnology A                  | 6         | 0         | 15   |
| BIOT3061            | Monoclonal Antibody and          |           |           |      |
|                     | Genetic Techniques in            | •         | ~         | 4.5  |
|                     | Biotechnology                    | 0         | 6         | 15   |
| MICH3041            | Immunology 1                     | 0         | 6         | 15   |
| MICR3071            | Environmental Microbiology       | o<br>alar | 0<br>hate | from |
| the following:      | inal 2 Level in subjects to be a | 50100     | licu      |      |
| BIOC3111            | Molecular Biology of Proteins    | s 6       | 0         | 15   |
| BIOC3271            | Cellular Biochemistry and        |           |           |      |
|                     | Control                          | 0         | 6         | 15   |
| MICR3051            | Immunology 2                     | 0         | 6         | 15   |
| General Educ        | ation Subject(s)                 | 2         | 2         | 15   |
| Total HPW Se        | ession 1 26                      |           |           |      |
| Total HPW Se        | ession 2 26                      |           |           |      |
| Total Credit F      | Points 135                       |           |           |      |
| Year 4              |                                  |           |           |      |
| BIOT3031            | Microbial Genetics               | 6         | 0         | 15   |
| BIOT3021            | Biotechnology B                  | 0         | 6         | 15   |
| BIOT4053            | Research Project                 | 18        | 18        | 90   |
| General Educ        | ation Subject(s)                 | 2         | 2         | 15   |
| Total HPW Se        | ession 1 26                      |           |           |      |
| Total HPW Se        | ession 2 26                      |           |           |      |
| Total Credit        | Points 135                       |           |           |      |
|                     |                                  |           |           |      |

### 3055

## **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, MicroEvolutionary Biology and Functional Biology well as the Chemical Engineering subjects 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.

|                     |                       | HF<br>S1 | PW<br>S2 | СР |
|---------------------|-----------------------|----------|----------|----|
| Year 1              |                       |          |          |    |
| CHEM1101            | Chemistry 1A and      | 6        | 0        | 15 |
| CHEM1201            | Chemistry 1B          | 0        | 6        | 15 |
| CHEN1020            | Engineering 1 CE      | 6        | 6        | 30 |
| MATH1131            | Mathematics 1A or     |          |          |    |
| MATH1141            | Higher Mathematics 1A | 6        | 0        | 15 |
| MATH1231            | Mathematics 1B or     |          |          |    |
| MATH1241            | Higher Mathematics 1B | 0        | 6        | 15 |
| PHYS1002            | Physics 1             | 6        | 6        | 30 |
| General Educ        | cation subject/s      | 2        | 2        | 15 |
| Total HPW S         | ession 1 26           |          |          |    |
| <b>Total HPW S</b>  | ession 2 26           |          |          |    |
| <b>Total Credit</b> | Points 135            |          |          |    |
| Year 2              |                       |          |          |    |

| DIODADAA       | Evolutionary and Eurotional |     |   |     |
|----------------|-----------------------------|-----|---|-----|
| BIOS1011       | Biology                     | 6   | 0 | 15  |
| CEIC2010       | Instrumental Analysis       | 3   | 3 | 15  |
| CEIC2020       | Computing                   | 1   | 2 | 7.5 |
| CEIC2030       | Applied Thermodynamics      |     |   |     |
|                | and Rate Processes          | 2.5 | 0 | 6.5 |
| CEIC2040       | Applied Electrochemical and |     |   |     |
| -              | Surface Properties          | 1.5 | 0 | 4   |
| CHEN2010       | Materials & Energy Balances | 2   | 2 | 10  |
| CHEN2020       | Flow of Fluids              | 2   | 2 | 10  |
| CHEN2030       | Heat Transfer               | 0   | 3 | 7.5 |
| CHEN2040       | Mass Transfer Fundamentals  | 0   | 2 | 5   |
| CHEN2050       | Chemical Engineering        |     |   |     |
|                | Laboratory 1                | 1   | 2 | 7.5 |
| ELEC0807       | Electrical Engineering 1E   | 0   | 3 | 7.5 |
| INDC2050       | Physical Processes Lab.     | 2   | 0 | 5   |
| MATH2021       | Mathematics 2               | 2   | 2 | 15  |
| MATH2819       | Statistics SA               | 2   | 2 | 10  |
| General Educa  | ation subject/s             | 2   | 2 | 15  |
| Total HPW Se   | ession 1 27                 |     |   |     |
| Total HPW Se   | Total HPW Session 2 25      |     |   |     |
| Total Credit F | Points 140.5                |     |   |     |

|                              | HPW<br>S1 S2           | СР  |              |                          | HI<br>S1 | PW<br>S2 | СР   |
|------------------------------|------------------------|-----|--------------|--------------------------|----------|----------|------|
| Year 3                       |                        |     | Year 4       |                          |          |          |      |
| BIOC2101 Principles of Bioch | emistry 6 0            | 15  | APSE0002     | Social Issues in Applied |          |          |      |
| BIOC2201 Principles of Mole  | cular                  |     |              | Science                  | 2        | 0        | 5    |
| Biology                      | 0 6                    | 15  | BIOT4063     | Research Project         | 2        | 10       | 30   |
| BIOT3100 Fermentation Proc   | cesses 0.2             | 5   | BIOT4093     | Biological Process       |          |          |      |
| CEIC3010 Reaction Engineer   | ring 0.3               | 75  |              | Engineering              | 6        | 6        | 30   |
| CHEN3010 Engineering Therm   | nodvnamice 4 0         | 10  | CHEN4030     | Safety and Environment   | 2        | 0        | 5    |
| CHEN3020 Numerical Method    |                        | 75  | CHEN4070     | Process Dynamics and     |          |          |      |
| CHEN3030 Eluids II           | 20                     | 7.5 |              | Control                  | 3        | 2        | 12.5 |
| CHEN3040 Separation Proces   | See 2.2                | 10  | CHEN4080     | Design Project           | 1        | 4        | 12.5 |
| CHEN3050 Particle Mechanics  |                        | 75  | CIVL0616     | Structures               | 3        | 0        | 7.5  |
| CHEN2060 Process Plant End   | vincoring I 4 4        | 7.5 | Total HDW 6  | oppion 1 DE              |          | -        |      |
| CHEN3070 Process Control     |                        | 20  | Total HDW S  |                          |          |          |      |
| CHEN3070 Chomical Enginee    | rina U Z               | 5   | Total Credit | Pointo 1025              |          |          |      |
| Chemical Enginee             | 1 mg                   | 76  | Total Credit | FOILS 102.5              |          |          |      |
| MICR2201 Introductory Microl | 1.3 1.3<br>hiology 6 0 | 1.5 |              |                          |          |          |      |
| MICH2201 Introductory Micro  | biology 6 U            | 15  |              |                          |          |          |      |
| Total HPW Session 1 25.5     |                        |     |              |                          |          |          |      |
| Total HPW Session 2 26.5     |                        |     |              |                          |          |          |      |
| Total Credit Points 130      |                        |     |              |                          |          |          |      |

# **Graduate Study**

The Department of Biotechnology conducts formal courses leading to the award of Master of Applied Science degrees in Biotechnology and Biopharmaceuticals. A Graduate Diploma in Biotechnology is also available.

In addition, the Department welcomes enquiries from graduates in Chemistry, Biochemistry, Microbiology, Applied Science, Chemical Engineering, Physiology, Nutrition and Agriculture who are interested in pursuing research in biotechnology for the award of the degrees of Master of Science 2036 and Doctor of Philosophy 1036.

The Head of Department 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**

# 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.

The Department of Biotechnology offers three formal masters courses, the Master of Applied Science (Biotechnology) **8042**, the Master of Applied Science (Biopharmaceuticals) **8043.1000**, and the Master of Applied Science (Biopharmaceuticals) by distance education **8043.2000**.

### 8042 Master of Applied Science (Biotechnology)

#### MAppSc(Biotech)

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:

|                       |                             | HF<br>S1 | w<br>S2 | СР |
|-----------------------|-----------------------------|----------|---------|----|
| BIOT7051              | Applied Genetics            | 0        | 5       | 20 |
| BIOT7061              | Peptide and Protein         |          |         |    |
|                       | Technology                  | 5        | 0       | 20 |
| BIOT7071              | Biochemical Engineering     | 5        | 0       | 20 |
| BIOT7081              | Environmental Biotechnology | 0        | 5       | 20 |
| BIOT7091              | Applied Cellular Physiology | 0        | 5       | 20 |
| BIOT7100              | Biological Principles       | 3        | 0       | 12 |
| BIOT7110              | Bioengineering Principles   | 3        | · 0     | 12 |
| BIOT7123              | Biotechnology Project Minor | 4        | 4       | 32 |
| Total HPW Se          | ession 1 17                 |          |         |    |
| <b>Total HPW Se</b>   | ession 2 19                 |          |         |    |
| <b>Total Credit P</b> | Points 144                  |          |         |    |

#### **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. 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.

#### 8043.1000 Master of Applied Science (Biopharmaceuticals)

#### MAppSc(Biopharmaceuticals)

This is an interdisciplinary program designed for graduates with backgrounds in either pharmacology or biotechnology who wish to obtain advanced training in both areas in order to gain expertise necessary for the development and use of the new generation of biopharmaceuticals which have been developed by, or result from, the application of molecular biology. It is open to graduates with a four year degree in a related discipline or who have, in the opinion of the Higher Degree Committee, acquired equivalent qualifications or experience. Prior study of biochemistry is required for the course. 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. The course is also offered through distance education. 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. Choice of subjects is dependent on the background of the student.

Principles of Pharmacology (PHPH5461) must be taken by students who have not completed an approved Pharmacology course, while Principles of Biotechnology (BIOT7040)) must be taken by students who have not completed an approved Biotechnology course program.

All students must pass Advanced Pharmacology (PHPH5471) and Advanced Biotechnology (BIOT7030). Course details are as follows:

|          |   | HF<br>S1 | PW<br>S2 | СР |
|----------|---|----------|----------|----|
| BIOT7060 | Biopharmaceuticals Project<br>(Minor) <i>or</i> | 4        | 4        | 32 |
| BIOT7050 | Biopharmaceuticals Project                      |          |          |    |
|          | (Major)   | 8        | 8        | 64 |
| BIOT7030 | Advanced Biotechnology                          | 3        | 3        | 24 |
| BIOT7040 | Biotechnology Principles                        | 6        | 2        | 32 |
| PHPH5461 | Pharmacology Principles                         | 5        | 3        | 32 |
| PHPH5471 | Advanced Pharmacology                           | 3        | 3        | 24 |
| PHPH5481 | Pharmacology Project                            |          |          |    |
|          | (Major) or                                      | 8        | 8        | 64 |
| PHPH5491 | Pharmacology Project                            |          |          |    |
|          | (Minor)   | 4        | 4        | 32 |

A recommended program for full-time students with a Ristochaology background would then be:

| Biotechnology | packground would then be.       |       |        |    |
|---------------|---------------------------------|-------|--------|----|
| BIOT7030      | Advanced Biotechnology          | 3     | 3      | 24 |
| PHPH5461      | Pharmacology Principles         | 5     | 3      | 32 |
| PHPH5471      | Advanced Pharmacology           | з     | 3      | 24 |
| BIOT7050      | Biopharmaceuticals Project      |       |        |    |
|               | (Major) or                      | 8     | 8      | 64 |
| PHPH5481      | Pharmacology Project            |       |        |    |
|               | (Major)                         | 8     | 8      | 64 |
| A recommende  | ed program for full-time studer | nts v | vith a |    |
| Pharmacology  | background would then be:       |       |        |    |
| BIOT7030      | Advanced Biotechnology          | 3     | 3      | 24 |
| BIOT7040      | Biotechnology Principles        | 6     | 2      | 32 |
| PHPH5471      | Advanced Pharmacology           | 3     | 3      | 24 |
| BIOT7050      | Biopharmaceuticals Project      |       |        |    |
|               | (Major)                         | 8     | 8      | 64 |
| PHPH5481      | Pharmacology Project            |       |        |    |
|               | (Major)                         | 8     | 8      | 64 |
|               |                                 |       |        |    |

#### **Elective Components**

If a minor project is selected, additional elective subject(s) may be selected from those offered by the Department of Biotechnology or the School of Physiology and Pharmacology, 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: (i) a major strand of related material comprising approximately 75% of the total program including a project comprising not less that 15% of the program (ii) a minor strand of broader based material comprising up to 25% of the total program.

### 8043.2000 Master of Applied Science (Biopharmaceuticals) Distance Education

The CRC for Biopharmaceutical Research has developed this strongly interdisciplinary Masters of Applied Science in Biopharmaceuticals course. The course teaches the scientific basis underscoring the development of recombinant biopharmaceuticals, combined with aspects of clinical trials, regulatory considerations, patent issues, and licencing. The course content is incorporated in 8 distance education modules comprised of written text and video/audio tapes containing course material, demonstrations and self-testing exercises. Access to the Subject Co-ordinators will be phone, fax, electronic mail and teleconferencing facilities.

The Master's Program can be completed in a minimum of 2 years. The minimum time option would entail the completion of two modules per session. These are offered concurrently. A maximum time for completion has been set at 8 years.

Modules consist of printed notes containing subject material, readings, assessment questions and exercises. Some modules also include audio and video taped material so access to audio equipment is essential.

The Master's Program calls for the completion of 8 modules coursework (exemptions may be allowed in exceptional circumstances) plus completion of a major project or two mini projects. Depending upon circumstances, projects may be industry or laboratory related or may be literature based. Completion of a minimum of 4 modules is required before projects may be commenced.

There will be two tutorials per session per module. These will be conducted via a multiple telephone link and will be structured and interactive.

Each module will be assessed separately at module completion and a certificate awarded. The assessment of modules will be flexible and will be based on two pieces of submitted work. This may be in the form of written assignments or as a timed, faxed examination.

Students module choices are from the following:

#### Module 1

#### Basic Principles of Drug Actions PHPH5501 Basic Principles of Drug Actions

This module covers general principles of pharmacodynamics and pharmacokinetics. Pharmacodynamics (what the drug does to the body) considers drug-receptor interactions, the basis of dose-response curves, reversible and irreversible antagonists, partial agonists and related topics. Events following the drug-receptor interaction, which include stimulation of second messenger systems and the pharmacology of ion channels, are described. The principles governing pharmacokinetics (what the body does to the drug) and their clinical importance are discussed in some detail. There are several simple graphical and problem solving exercises to be completed to aid in your understanding of this material.

#### Module 2 PHPH5511 Selected Tenid

### PHPH5511 Selected Topics in Pharmacology

For this module the topics were chosen to enable students to gain knowledge of the receptors in the human body with which drugs commonly interact to produce their main clinical effects, or their side-effects/toxicological actions. The module begins with an introduction to the autonomic nervous system, then works through autonomic receptors, receptors for histamine and serotonin, then to the newer areas of peptide receptors and cytokines, the latter areas being those for which drugs are now being developed. With this background, plus some reading material on receptors for drugs affecting the central nervous system, it is felt that students will be able to read and understand the pharmacology of most drugs in clinical use. A video which covers many autonomic drug effects on the cardiovascular system, plus questions based around this film, are included.

#### Module 3

### PHPH5521 Techniques for Drug Development

This module extends the concepts raised and discussed in the Basic Pharmacokinetics section of Module 1. More advanced pharmacokinetic problems, such as compartmentation, kinetics of effects and problem solving are included. The technique of measuring receptor binding is shown in some detail on video, with explanation of how the technique is set up, and how and why it is much used in new drug development. Also included in this module is a section on techniques used in the assay of drugs. The determination of molecular structure, and quantitation of drugs in the body are vital areas of drug development, and indeed pharmacokinetics depends upon such quantitation.

#### Module 4

# PHPH5531 Discovery and Development of New Medicines

This module gives an overview of most aspects of the development of new drugs. There is a very short historical introduction and examples of the discovery and development of drugs from natural products (plants) plus some examples of drugs developed using synthetic programs (chemical modifications). There is an example of a Natural Products program with examples of broad based screens and follow up testing in animals (Phase 0) followed by a section on the necessary toxicological testing in animals (also Phase 0) before a drug can be tested in humans. Phase 1-4 of clinical trials are then discussed, followed by the Pharmaceutical Company's and the Clinical Investigator's viewpoints of drug development. Regulatory issues and some ethical problems are briefly considered.

#### Module 5

### **BIOT7070 Production of Recombinant Products**

In this module, the topics deal with some basic recombinant DNA techniques and then heterologous protein expression in prokaryotes and eukaryotes are discussed in greater details. For prokaryotes, *Escherichia coli* is the model species chosen and for eukaryotes, the cell systems of yeast and mammalian cells are described. The advantages and disadvantages of the various expression cell systems are outlined. The vectors used for cloning of the protein genes are also described and illustrated. Cloning of genes into the vectors, production and subsequent characterisation of the recombinant protein are also described. These examples are actual biopharmaceutical products currently produced by the biotechnology industry and students are referred to published journal papers throughout the modules.

#### Module 6

#### BIOT7080 Principles of Fermentation and Downstream Processing

The units in this module were selected to give the students a good understanding of the fundamental principles associated with biopharmaceuticals manufacture. The module begins by discussing basic fermentation principles for the large-scale culture of bacterial and mammalian cells to produce recombinant protein biopharmaceuticals. This is followed by a thorough study of the main unit operations associated with product recovery, commonly referred to as downstream processes. The principles of Good Manufacturing Practice are discussed in the third unit, which is relevant to all aspects of drug manufacturing, including fermentation and product recovery operations. This unit is thus designed to put regulatory principles into the context of biopharmaceutical manufacture. The last unit covers modern methods of product characterisation, which forms a critical component of the regulatory procedure.

#### Module 7

#### BIOT7090 Monoclonal Antibody Technology

This module is made up of 4 units covering techniques for the production of monoclonal antibodies and discussing their therapeutic applications. Unit 1 is designed as an introduction to immunology, emphasising the areas of immunology relevant to antibody production. In addition the structure of antibody molecules is studied in detail. Unit 2 describes the processes in the production of hybridomas, the specialised cells which produce monoclonal antibodies. This unit includes information on immunisation protocols. methods of cell fusion and selection, and the production of human monoclonal antibodies by EBV-transformed B cells. Unit 3 is associated with the more recent developments in antibody engineering techniques. The phage display system, and genetic manipulations for the production of humanised antibodies and antibody fragments are described in details. Unit 4 covers the applications of monoclonal antibodies both for in vivo diagnostics and for therapy. Also, some of the more recent innovations such as the production of recombinant immunotoxins are described.

#### Module 8

# BIOT7120 Regulatory Considerations, Patent Issues and Licensing

The first unit of this module looks at the code of Good Manufacturing Practice (GMP) for the production of recombinant biopharmaceuticals and the establishment of Standard Operating Procedures (SOPs) for a production process. This is especially relevant as many of the M.App.Sc. (Biopharmaceuticals) graduates will take up positions in industry. The international biopharmaceutical industry is a vigorous, rapidly growing industry. Compared to the pharmaceutical industry it is still at a fairly early stage of development and undergoing some interesting changes. The second unit provides an understanding of the nature of the biopharmaceutical industry at this stage of its evolution. It includes the concept of licensing as an important factor in its development as well as an appreciation of the basics of licensing activity. The final unit introduces the student to the concept of intellectual property as it relates to biopharmaceuticals and provides some guidelines on its management. Intellectual property is the collection of statute and common law principles giving ownership of inventions, trade secrets, trade marks, designs and copyright in literary and artistic works to their creators. The creation and protection of intellectual property is the basis on which development and commercialisation of biopharmaceuticals is built and as such is of vital concern to the industry. This unit will provide a detailed consideration of patents and trade secrets and touch briefly on the subject of trade mark registrations, industrial design registrations and copyright. Special issues relating to patents and trade secrets in biopharmaceuticals will also be examined.

#### Module 9

#### BIOT7130 Biotechnology Mini Project 1

A small experimental or design project, or an extensive literature review and analysis of a selected topic in biotechnology.

#### Module 10

#### BIOT7140 Biotechnology Mini Project 2

A small experimental or design project, or an extensive literature review and analysis of a selected topic in biotechnology.

#### Modules 9 and 10

#### BIOT7150 Biotechnology Major Project

An experimental or technical investigation or design project in the general field of biotechnology.

#### Module 9

#### PHPH5541 Pharmacology Mini Project 1

A small laboratory or industry based project or an extensive literature review or extensive data analysis in the area of drug development.

#### Module 10

#### PHPH5551 Pharmacology Mini Project 2

A small laboratory or industry based project or an extensive literature review or extensive data analysis in the area of drug development.

#### Modules 9 & 10

#### PHPH5561 Pharmacology Major Project

A laboratory or industry based project in the area of drug development.

### 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.

|              |                             | S1    | S2 | UF   |
|--------------|-----------------------------|-------|----|------|
| Compulsory   | subjects                    |       |    |      |
| BIOT3011     | Biotechnology A             | 6     | 0  | 15   |
| BIOT3021     | Biotechnology B             | 0     | 6  | 15   |
| BIOT5013     | Practical Biotechnology     | 6     | 6  | 30   |
| Elective sub | jects                       |       |    |      |
| BIOT3031     | Microbial Genetics          | 6     | 0  | 15   |
| BIOT3061     | Monoclonal Antibody and     |       |    |      |
|              | Genetic Techniques in       |       |    |      |
|              | Biotechnology               | 0     | 6  | 15   |
| BIOT7100     | Biological Principles       | 3     | 0  | 12   |
| BIOT7110     | Bioengineering Principles   | 3     | 0  | 12   |
| BIOT8010     | Graduate Seminars           | 2     | 2  | 8    |
| MICR2011     | Microbiology 1              | 0     | 6  | 15   |
| Other suitab | le electives from the Depar | tment | of | Food |

1100104

~ ~

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

# **Department of Food Science and Technology**

### Head of Department

Professor KA Buckle

Food science and technology involves the understanding of basic sciences and the application of this knowledge to foods from the point of production, through handling, processing, preservation, distribution and marketing, up to consumption and utilisation by consumers. It is concerned with food processes, food commodities, food composition and food quality (including sensory properties, safety and nutritional value).

The study of food science and technology integrates many scientific disciplines. Its bases are in chemistry, physics, biochemistry and microbiology. Its borders merge with those of agriculture, engineering, human nutrition, public health, commerce, psychology and law. Biotechnology has a role of increasing importance in food science and technology.

The food scientist and food technologist are concerned with population food supplies and requirements, community wants and needs, and equitable distribution of foods to ensure human nutritional needs are met.

New knowledge is acquired in the laboratory, the pilot plant, and the community, and then applied to the development of safe, nutritious and palatable foods, beverages and food ingredients by optimisation of processes and equipment. Foods are studied in terms of their basic constituents and structures, and the changes they undergo when subjected to handling, processing and distribution.

The food scientist and food technologist are equally concerned with the development and selection of raw materials from agricultural, horticultural, animal and marine sources. A safe, adequate, palatable and nutritious food supply is essential to human health. The food and beverage industry is of major economic importance and in Australia is the largest sector of manufacturing industry. Internationally, food production, processing and service are among the largest and most stable industries. The challenges are to increase the availability, variety, quality and quantity of foods economically and in line with the needs of the world population. The Australian industry has a major role to play in supplying high quality foods to emerging overseas markets and there is a national and international demand for professionally trained people prepared to accept responsibility for the quality and safety of food.

The Department offers a four-year full-time course leading to the award of Bachelor of Science and a 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 Australian Institute of Food Science and Technology, the US Institute of Food Technologists, and may qualify for membership of the Royal Australian Chemical Institute.

Graduate Diploma and Master of Applied Science courses in Food Science and Technology are offered for graduates in science or agriculture wishing to familiarise themselves with the principles of food science and technology.

The courses provide basic preparation for food science and technology careers in the food industry, the public sector, education, research, the food service industry, public health, management and marketing. Graduates may also find careers in health and environmental sciences, management of food resources and food wastes, and communication, and in areas such as dietetics after further training.

# Undergraduate Study

# **Course Outlines**

| 3060                 |                  |                   |          |         |      |                       |  | HP<br>S1 | W<br>S2 | СР  |
|----------------------|------------------|-------------------|----------|---------|------|-----------------------|--|----------|---------|-----|
| Food Scienc          | e and Techn      | ology             |          |         |      | Year 3                |  |          |         |     |
| Full-time Co         | ourse            |                   |          |         |      | BIOT3041<br>CHEM3926  | Principles of Biotechnology<br>Instrumental Methods of | 3        | 0       | 7.5 |
| <b>Bachelor of S</b> | icience          |                   |          |         |      |                       | Food Analysis  | 0        | 3       | 7.5 |
| BSc                  |                  |                   |          |         |      | CHEM3929              | Food Chemistry   | 6        | 0       | 15  |
| 200                  |                  |                   |          |         |      | FOOD1310              | Food Preservation                                      | 6        | 0       | 15  |
| This course is a     | designed to prov | vide depth and    | brea     | udth in | the  | FOOD1320              | Plant Food Science                                     | 2        | 0       | 5   |
| relevant physi       | cal and biologi  | cal sciences o    | n w      | hich f  | ood  | FOOD1330              | Animal Food Science                                    | 3        | 0       | 7.5 |
| science and te       | chnology is bas  | ed. Students c    | omp      | leting  | the  | FOOD1340              | <b>Quality Evaluation &amp; Control</b>                | 0        | 2       | 5   |
| Year 1 require       | ments are eligib | le for selection  | for a    | admis   | sion | FOOD1350              | Food Technology Laboratory                             | 0        | 6       | 15  |
| to Year 2 of th      | ne course. It is | strongly recon    | nme      | nded    | that | FOOD2310              | Food Microbiology                                      | 4        | 0       | 10  |
| students obtain      | n, before the co | ompletion of th   | e co     | ourse   | and  | FOOD3310              | Nutrition  | 0        | 3       | 7.5 |
| during recess        | periods, as mu   | ch professiona    | lly o    | riente  | d or | FOOD4310              | Food Process Engineering                               | 0        | 4       | 10  |
| industrial expe      | rience as possi  | ble.              |          |         |      | FOOD4320              | Computer Applications                                  | 0        | 2       | 5   |
|                      |                  |                   |          |         | ~~   | General Educa         | ation subject/s  | 0        | 4       | 15  |
|                      |                  |                   | HP<br>C1 | W 60    | CP   | Total HPW Se          | ession 1 24  |          |         |     |
|                      |                  |                   | 31       | 32      |      | Total HPW Se          | ession 2 24  |          |         |     |
| Year 1               |                  |                   |          |         |      | <b>Total Credit F</b> | Points 125   |          |         |     |
| BIOS1101             | Evolutionary a   | nd Functional     | ~        | ~       | 45   |                       |  |          |         |     |
| RICEIDOI             | Biology          | lle and Conce     | 0        | C<br>C  | 15   | Year 4                |  |          |         |     |
| BIUSIZUI             | Chomistry 1 A    | lis and Genes     | C<br>C   | 0       | 15   | APSE0002              | Social Issues in Applied                               |          |         |     |
| CHEMIIOI             | Chemistry 1A     |                   | 0        | Ê       | 15   |                       | Science  | 2        | 0       | 5   |
|                      | Energine Societ  |                   | 5        | 0       | 10   | FOOD1400              | Project  | 8        | 8       | 40  |
| MATH1141             | Higher Mather    | y<br>natice 1A or | 2        | 0       | 5    | FOOD1410              | Field Excursions                                       | 3        | 0       | 7.5 |
| MATH1131             | Mathematics 1    | A or              |          |         |      | FOOD1420              | Food Legislation                                       | 2        | 0       | 5   |
| MATH1011             | General Mathe    | matics 1B         | 6        | ٥       | 15   | FOOD1430              | Food Industry Management                               | 2        | 0       | 5   |
| and                  | General maine    |                   | Ŭ        | Ŭ       | 10   | General Educa         | ation Subject/s  | 0        | .4      | 15  |
| MATH1241             | Higher Mather    | natics 1B or      |          |         |      | Plus three or r       | nore of the following electives                        | to a     | total   | of  |
| MATH1231             | Mathematics 1    | B or              |          |         |      | not less than 4       | 2.5 credit points.                                     |          |         |     |
| MATH1021             | General Mathe    | ematics 1C        | 0        | 6       | 15   | F00D1440              | Pour Quality and Product                               | ^        | 6       | 15  |
| PHYS1002             | Physics 1 or     |                   |          |         |      | E0001450              | Ecod Processing Wastes                                 | 0        | 2       | 75  |
| PHYS1022             | Introductory Pl  | hysics 1          | 6        | 6       | 30   | F00D1450              | Cereal Technology                                      | ň        | 6       | 15  |
| Total HDW Se         | seion 1          | 26                |          |         |      | FOOD1470              | Postbarvest Technology of                              | v        | v       | 10  |
| Total HPW Se         | ssion 2          | 24                |          |         |      | 100014/0              | Foods  | 6        | 0       | 15  |
| Total Credit P       | Points           | 125               |          |         |      | FOOD2410              | Advanced Food Microbiology                             | ۰Õ       | 6       | 15  |
|                      | •                |                   |          |         |      | FOOD2430              | Quality Assurance and                                  | -        | -       |     |
| Year 2               |                  |                   |          |         |      |                       | Food Microbiology                                      | 2        | 0       | 5   |
| BIOC2101             | Principles of B  | iochemistry       | 6        | 0       | 15   | FOOD2440              | Microbial Food Spoilage                                | 0        | 1       | 2.5 |
| BIOC2201             | Principles of M  | lolecular         |          |         |      | FOOD2450              | Foodborne Microogranisms                               |          |         |     |
|                      | Biology          |                   | 0        | 6       | 15   |                       | of Public Health Significance                          | 0        | 2       | 5   |
| CHEM2021             | Organic Chem     | istry             | 5        | 1       | 15   | FOOD2460              | Food and Beverage                                      |          |         |     |
| CHEM2041             | Chemical and     | Spectroscopic     |          |         |      |                       | Fermentations  | 0        | 2       | 5   |
|                      | Analysis         |                   | 0        | 6       | 15   | FOOD2470              | Microorganisms as Food                                 |          |         |     |
| CHEM2819             | Physical Chem    | nistry for Food   |          |         |      |                       | Processing Aids and                                    |          |         |     |
|                      | and Fibre Scie   | nce and           |          |         |      |                       | Ingredients  | 0        | 1       | 2.5 |
|                      | Technology       |                   | 0        | 6       | 15   | FOOD3410              | Nutrient Analysis of Foods                             | 6        | 0       | 15  |
| FOOD3210             | Introductory N   | utrition          | 3        | 0       | 7.5  | FOOD3420              | Population & Applied Nutrition                         | 0        | 2       | 5   |
| F00D4210             | Introductory Fo  | od Engineering    | 3        | 0       | 7.5  | F00D3430              | Special Dietary Foods and                              |          |         |     |
| MATH2819             | Statistics SA    |                   | 2        | 2       | 10   | F0004400              | Ingreatents  | 1        | 0       | 2.5 |
| MICH2218             | MICRODIOIOGY     |                   | 6        | 2       | 20   | FUUD4420              | Adupted Food Food                                      | 3        | 0       | 7.5 |
| <b>Total HPW Se</b>  | ession 1         | 25                |          |         |      |                       | Advanced Food Engineering A                            | 3        | 0       | 7.5 |
| <b>Total HPW Se</b>  | ession 2         | 23                |          |         |      | F0004440              | Auvanceu Food Engineering B                            | U        | 3       | 1.5 |
| Total Credit P       | oints            | 120               |          |         |      | Total Credit F        | Points 120   |          |         |     |

or such other electives to a total of not less than 42.5 credit points, as approved by the Head of Department. Year 4 totals at least 120 credit points.

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

Detailed reports of the students' activities during their periods in industry are required.

#### 3065

### Honours in Food Science Full-time Course

#### Bachelor of Science (Honours) BSc (Hons)

This course is designed to provide extensive research training in some aspects of food science and technology, at undergraduate level. The research orientation of the course, compared to the Graduate Diploma, facilitates entry into a research higher degree (MSc/PhD) upon completion of Honours at a satisfactory level.

Entry to the course requires satisfactory completion of a Bachelor degree, or equivalent, in an area considered relevant to food science and technology. Students who have completed a four-year Bachelor course, in which Honours has already been awarded, are specifically excluded.

The major component of the course is an extensive research project, conducted throughout one year of full time study. Candidates also take 10 credit points of subjects within the Department, or such other subjects as approved by the Head of Department, in each session, and complete a program of General Studies, dealing with social and ethical issues relevant to food science and technology. Honours is awarded on the basis of performance in the research project and satisfactory completion of coursework.

| HPW<br>S1 S2 | СР                                  |
|--------------|-------------------------------------|
|              |                                     |
| 20 20        | 100                                 |
| 22           | 10                                  |
| 22           | 15                                  |
|              |                                     |
|              |                                     |
|              |                                     |
|              | HPW<br>S1 S2<br>20 20<br>2 2<br>2 2 |

\*Subjects offered by the Department of Food Science and Technology or as approved by the Head of Department and dependent on the background of the candidate. Credit points for coursework subjects may be concentrated in one session.

### 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 specialise 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 day-time classes, and substantial day-time 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.

|                |                             | HF<br>S1 | w<br>S2 | СР |
|----------------|-----------------------------|----------|---------|----|
| Stages 1 and   | 2                           |          |         |    |
| BIOS1101       | Evolutionary and Functional |          |         |    |
|                | Biology                     | 6        | 0       | 15 |
| BIOS1201       | Molecules, Cells and Genes  | 0        | 6       | 15 |
| CHEM1101       | Chemistry 1A                | 6        | 0       | 15 |
| CHEM1201       | Chemistry 1B                | 0        | 6       | 15 |
| FOOD1100       | Food in Society             | 2        | 0       | 5  |
| MATH1141       | Higher Mathematics 1A or    |          |         |    |
| MATH1131       | Mathematics 1A or           |          |         |    |
| MATH1011       | General Mathematics 1B      | 6        | 0       | 15 |
| MATH1241       | Higher Mathematics 1B or    |          |         |    |
| MATH1231       | Mathematics 1B or           |          |         |    |
| MATH1021       | General Mathematics 1C      | 0        | 6       | 15 |
| PHYS1002       | Physics 1 or                |          |         |    |
| PHYS1022       | Introductory Physics 1      | 6        | 6       | 30 |
|                |                             |          |         |    |
| Total HPW Se   | ession 1 26                 |          |         |    |
| Total HPW Se   | ession 2 24                 |          |         |    |
| Total Credit F | Points 125                  |          |         |    |

Note: Physics and Mathematics are usually taken as Stage 1, the other subjects as Stage 2

| Stage 3<br>BIOC2101Principles of Biochemistry<br>Principles of Molecular<br>Biology6015Stage 5<br>BIOT3041Principles of Biotechnology<br>Principles of Biotechnology307.5<br>FOBIOC2201Principles of Molecular<br>Biology0615BIOT3041Principles of Biotechnology307.5<br>FOCHEM2021Physical Chemistry for Food<br>and Fibre Science and<br>Technology5115FOOD3310Nutrition037.5<br>FOOD4320CHEM2041Chemical and Spectroscopic<br>Analysis0615FOOD4320Computer Applications025Cotal HPW Session 11111Total HPW Session 11313131410Total Credit Points6015FOOD1320Instrumental Methods of<br>FOOD13107037.5FOOD3210Introductory Nutrition307.5FOOD1320Plant Food Science307.5FOOD3210Introductory Food Engineering307.5FOOD1320Plant Food Science307.5FOOD3210Introductory Food Engineering307.5FOOD1320Plant Food Science307.5FOOD1320Plant Food Science307.5FOOD1320Plant Food Science307.5FOOD1320Introductory Food Engineering307.5FOOD1320Plant Food Science307.5FOOD1320Introd   |                              |                               | HF<br>S1 | W<br>S2 | СР       |                                |   | HP<br>S1 | W<br>S2 | СР       |
|--|------------------------------|-------------------------------|----------|---------|----------|--------------------------------|---|----------|---------|----------|
| BIOC2201Principles of MolecularCHEM3929Food Chemistry6015Biology0615FOOD2310Food Microbiology4010CHEM2021Physical Chemistry for Food<br>and Fibre Science and<br>Technology5115FOOD4310Food Process Engineering0410CHEM2041Chemical and Spectroscopic<br>Analysis0615FOOD4320Computer Applications025Total HPW Session 11111Total HPW Session 113Total HPW Session 113Total HPW Session 113Total Credit Points60515FOOD1320Plant Food Science205FOOD3210Introductory Nutrition<br>Trotal Credit Points37.5FOOD1320Plant Food Science307.5FOOD3210Introductory Nutrition<br>Trotal Credit Points307.5FOOD1330Animal Food Science307.5FOOD1320Plant Food Science307.5FOOD1330Animal Food Science307.5FOOD1340Quality Evaluation and Control02551515515MATH2819Statistics SA2210FoOD1350Food Technology Laboratory0615MICR2218Microbiology6220General Education subject/s2215Total HPW Session 114Total HPW Session 1   | Stage 3<br>BIOC2101          | Principles of Biochemistry    | 6        | 0       | 15       | Stage 5<br>BIOT3041            | Principles of Biotechnology                       | 3        | 0       | 7.5      |
| Biology0613FOOD2310Nutrition037.5CHEM2021Physical Chemistry for Food<br>and Fibre Science and<br>Technology5115FOOD3310Nutrition037.5CHEM2041Chemical and Spectroscopic<br>Analysis0615FOOD4320Computer Applications025CHEM2041Chemical and Spectroscopic<br>Analysis0615Total HPW Session 11313131410Total HPW Session 11111Total HPW Session 213Total Credit Points707075Total HPW Session 213Total Credit Points7075FOOD1310Food Preservation6015Stage 4FOOD2210Introductory Nutrition307.5FOOD1320Plant Food Science205FOOD2210Introductory Food Engineering307.5FOOD1320Plant Food Science307.5FOOD2210Introductory Food Engineering307.5FOOD1330Animal Food Science307.5FOOD2210Introductory Food Engineering307.5FOOD1300Food Technology Laboratory0615MATH2819Statistics SA2210FooD1350Food Technology Laboratory0615MICR2218Microbiology6220General Education subject/s2215 <tr< td=""><td>BIOC2201</td><td>Principles of Molecular</td><td>~</td><td>6</td><td>15</td><td>CHEM3929</td><td>Food Chemistry</td><td>6<br/>4</td><td>0</td><td>15<br/>10</td></tr<>   | BIOC2201                     | Principles of Molecular       | ~        | 6       | 15       | CHEM3929                       | Food Chemistry                                    | 6<br>4   | 0       | 15<br>10 |
| and Fibre Science and<br>Technology5115FOOD4310Food Process Engineering0410CHEM2041Chemical and Spectroscopic<br>Analysis0615FOOD4320Computer Applications025Total HPW Session 11111Total HPW Session 213Total HPW Session 213Total HPW Session 213Total Credit Points60551551515Stage 4<br>CHEM2819Physical Chemistry for Food<br>and Fibre Science and<br>Technology06155FOOD1310Food Analysis037.5FOOD3210Introductory Nutrition<br>Microbiology37.5FOOD1320Plant Food Science<br>  | CHEM2021                     | Physical Chemistry for Food   | U        | 0       | 10       | FOOD3310                       | Nutrition   | Ó        | 3       | 7.5      |
| Total HPW Session 113Total HPW Session 113Total HPW Session 111Total HPW Session 111Total HPW Session 111Total HPW Session 111Total HPW Session 113Total HPW Session 213Total HPW Session 213Total HPW Session 213Total HPW Session 213Total HPW Session 113FOOD3210Introductory Nutrition306Statistics SA210FOOD1320Plant Food Science20Statistics SA210FOOD1320Plant Food Science37.5FOOD1330Animal Food Science20Statistics SA210FOOD1320Plant Food Science37.5FOOD1330Animal Food Science30Total HPW Session 113Total HPW Session 113<th colspan="</td> <td></td> <td>and Fibre Science and</td> <td>5</td> <td>1</td> <td>15</td> <td>FOOD4310</td> <td>Food Process Engineering<br/>Computer Applications</td> <td>0<br/>0</td> <td>4<br/>2</td> <td>10<br/>5</td>   |                              | and Fibre Science and         | 5        | 1       | 15       | FOOD4310                       | Food Process Engineering<br>Computer Applications | 0<br>0   | 4<br>2  | 10<br>5  |
| Analysis0615Total HPW Session 113Total HPW Session 21313Total HPW Session 213Total HPW Session 213Total Credit Points70Total Credit Points60Stage 6Stage 4Stage 6CHEM3926Instrumental Methods of<br>Food Analysis0CHEM2819Physical Chemistry for Food<br>and Fibre Science and<br>Technology0615FOOD3210Introductory Nutrition307.5FOOD1320Plant Food Science205FOOD4210Introductory Food Engineering307.5FOOD1340Quality Evaluation and Control025MATH2819Statistics SA2210FOOD1350Food Technology Laboratory0615MICR2218Microbiology6220General Education subject/s2215Total HPW Session 114Total HPW Session 213131313  | CHEM2041                     | Chemical and Spectroscopic    | 5        |         | 15       | General Educ                   | ation subject/s                                   | Ō        | 4       | 15       |
| Total HPW Session 111Total HPW Session 213Total HPW Session 113Total HPW Session 114Total HPW Session 113Total HPW Session 114Total HPW Session 113  |                              | Analysis                      | 0        | 6       | 15       | Total HPW Se                   | ession 1 13                                       |          |         |          |
| Total Credit Points60Stage 4Stage 6CHEM2819Physical Chemistry for Food<br>and Fibre Science and<br>Technology0615FOOD1310Food Analysis037.5FOOD1320Introductory Nutrition307.5FOOD1320Plant Food Science205FOOD4210Introductory Food Engineering307.5FOOD1340Quality Evaluation and Control025MATH2819Statistics SA2210FOOD1350Food Technology Laboratory0615MICR2218Microbiology6220General Education subject/s2215Total HPW Session 114Total HPW Session 2131314   | Total HPW Se<br>Total HPW Se | ssion 1 11<br>ssion 2 13      |          |         |          | Total HPW So<br>Total Credit I | ession 2 13<br>Points 70                          |          |         |          |
| Stage 4CHEM2819Physical Chemistry for Food<br>and Fibre Science and<br>Technology0615Food Analysis037.5FOOD3210Introductory Nutrition307.5FOOD1320Plant Food Science205FOOD4210Introductory Food Engineering307.5FOOD1340Quality Evaluation and Control025MATH2819Statistics SA2210FOOD1350Food Technology Laboratory0615MICR2218Microbiology6220General Education subject/s2215Total HPW Session 114Total HPW Session 1131314Total HPW Session 213  | Total Credit P               | oints 60                      |          |         |          | Store 6                        |   |          |         |          |
| CHEM2819Physical Chemistry for Food<br>and Fibre Science and<br>TechnologyFoodFood Analysis037.5FOOD3210Introductory Nutrition307.5FOOD1320Plant Food Science205FOOD4210Introductory Food Engineering307.5FOOD1330Animal Food Science307.5MATH2819Statistics SA2210FOOD1350Food Technology Laboratory0615MICR2218Microbiology6220General Education subject/s2215Total HPW Session 114Total HPW Session 113131314   | Stage 4                      |                               |          |         |          | CHEM3926                       | Instrumental Methods of                           |          |         |          |
| and Fibre Science and<br>Technology0615FOOD 1310Food Preservation6015FOOD 3210Introductory Nutrition307.5FOOD 1320Plant Food Science205FOOD 4210Introductory Food Engineering307.5FOOD 1340Quality Evaluation and Control025MATH2819Statistics SA2210FOOD 1350Food Technology Laboratory0615MICR2218Microbiology6220General Education subject/s2215Total HPW Session 114Total HPW Session 11313Total HPW Session 213   | CHEM2819                     | Physical Chemistry for Food   |          |         |          |                                | Food Analysis                                     | 0        | 3       | 7.5      |
| FOOD3210Introductory Nutrition307.5FOOD1330Animal Food Science307.5FOOD4210Introductory Food Engineering307.5FOOD1340Quality Evaluation and Control025MATH2819Statistics SA2210FOOD1350Food Technology Laboratory0615MICR2218Microbiology6220General Education subject/s2215Total HPW Session 114Total HPW Session 113Total HPW Session 213  |                              | and Fibre Science and         | 0        | 6       | 15       | F00D1310                       | Plant Food Science                                | 2        | 0       | 5        |
| FOOD4210Introductory Food Engineering 307.5FOOD1340Quality Evaluation and Control025MATH2819Statistics SA2210FOOD1350Food Technology Laboratory0615MICR2218Microbiology6220General Education subject/s2215Total HPW Session 114Total HPW Session 113Total HPW Session 21013Total HPW Session 213   | FOOD3210                     | Introductory Nutrition        | 3        | ŏ       | 7.5      | FOOD1330                       | Animal Food Science                               | 3        | Ō       | 7.5      |
| MATH2819   Statistics SA   2   2   10   FOOD1350   Food recimining Laboratory 0   0   13     MICR2218   Microbiology   6   2   20   General Education subject/s   2   2   15     Total HPW Session 1   14   Total HPW Session 1   13     Total HPW Session 2   10   Total HPW Session 2   13   | FOOD4210                     | Introductory Food Engineering | 3        | 0       | 7.5      | FOOD1340                       | Quality Evaluation and Control                    | 0        | 2       | 5<br>15  |
| Total HPW Session 1 14 Total HPW Session 1 13  | MATH2819<br>MICB2218         | Statistics SA<br>Microbiology | 2<br>6   | 2<br>2  | 10<br>20 | General Educ                   | ation subject/s                                   | 2        | 2       | 15       |
| Total HPW Session 2 10 Total HPW Session 2 13  | Total HDW Se                 | secion 1 14                   |          |         |          | Total HPW S                    | ession 1 13                                       |          |         |          |
| IOTAL MARK Session 2 IU TOTAL III TOTAL IIII TOTAL III TOTAL IIII TOTAL III TOTALII TOTALIII TOTALII III TOTALII TOTALII III TOTALII TOT | Total HPW Se                 | ession 2 10                   |          |         |          | Total HPW S                    | ession 2 13                                       |          |         |          |
| Total Credit Points 60 Total Credit Points 70  | Total Credit F               | Points 60                     |          |         |          | Total Credit                   | Points 70   |          |         |          |

# **Graduate Study**

The Department of Food Science and Technology conducts formal courses leading to the award of Master of Applied Science degrees in Food Technology, Food Microbiology, Food Engineering and Food Science and Nutrition and a Graduate Diploma in Food Technology. These courses are one year full-time or two years part-time.

In addition, the Department welcomes enquiries from graduates in Chemistry, Biochemistry, Microbiology, Applied Science, Chemical Engineering, Physiology,

Nutrition and Agriculture who are interested in pursuing research in food science and technology for the award of the degrees of Master of Science 2031 and Doctor of Philosophy 1031.

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

### **Course Outlines**

### 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             | 8032.1000 |
|------------------------------------|-----------|
| Food Microbiology Course           | 8032.2000 |
| Food Engineering Course            | 8032.3000 |
| Food Science and Nutrition Course* | 8032.4000 |
|                                    |           |

\*Subject to Academic Board approval.

### **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 at least 126 credit points (3.5 credit points equals 1 hour of class contact per week for one session) made up of compulsory subjects, a compulsory project (either 21 or 42 or 63 credit points) 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 credit points must be completed by taking other approved subjects. The degree will comprise one year of full-time study (normally two sessions of at least 63 credit points each) or two years of part-time study (normally four sessions of at least 31.5 credit points 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 will not be included in credit points.

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.

### 8032.1000 Food Technology

#### 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                            | CP* |
|------------------------|-------------------------------------|-----|
| FOOD1527               | Principles of Food Preservation     | 21  |
| FOOD1557               | Food Technology Laboratory          | 21  |
| FOOD1707               | Seminar                             | 7   |
| Compulsory  <br>Either | project                             |     |
| F00D1717               | Major Research Project or           | 63  |
| FOOD1727               | Research Project or                 | 42  |
| FOOD1737               | Minor Project                       | 21  |
| * Credit points m      | nay be concentrated in one session. |     |

#### **Elective subjects**

Elective subjects making up the remainder of the credit points 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.

### 8032.2000 Food Microbiology

#### Master of Applied Science MAppSc

The MAppSc 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 s   | subjects                             | CP*   |
|----------------|--------------------------------------|-------|
| FOOD2597       | Food Microbiology Seminar            | 7     |
| FOOD2517       | Food Microbiology                    | 14    |
| FOOD2527       | Microbiological Examination of Foods | 21    |
| FOOD2537       | Microbiological Quality Assurance    | 7     |
| Compulsory     | project                              |       |
| Either         |                                      |       |
| FOOD2617       | Major Research Project in Food       |       |
|                | Microbiology or                      | 63    |
| FOOD2607       | Food Microbiology Research Project a | or 48 |
| FOOD2547       | Food Microbiology Project            | 21    |
| Elective subje | ects                                 |       |
| FOOD1517       | Chemistry, Biochemistry and Physics  |       |
|                | of Foods                             | 10.5  |
| FOOD1527       | Principles of Food Preservation      | 21    |
| FOOD2507       | Introductory Microbiology            | 10.5  |
| FOOD2557       | Microbial Spoilage of Foods          | 3.5   |
| FOOD2567       | Foodborne Microorganisms of Public   |       |
|                | Health Significance                  | 7     |
| FOOD2577       | Food and Beverage Fermentations      | 7     |
| FOOD2587       | Microorganisms as Food Processing    |       |
|                | Aids and Ingredients                 | 3.5   |
| or other subje | cts offered by the Departments of f  | Food  |

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.

\* Credit points may be concentrated in one session.

### 8032.3000 Food Engineering

#### Master of Applied Science MAppSc

The MAppSc course in Food Engineering is a formal course designed for graduates in Engineering or related disciplines 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 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.

| Compulsory subjects  |                             |      |  |  |  |
|----------------------|-----------------------------|------|--|--|--|
| FOOD1707             | Seminar                     | 7    |  |  |  |
| FOOD4557             | Food Engineering Laboratory | 10.5 |  |  |  |
| FOOD4567             | Food Engineering Field Work | 10.5 |  |  |  |
| FOOD4587             | Advanced Food Engineering A | 14   |  |  |  |
| FOOD4597             | Advanced Food Engineering B | 14   |  |  |  |
| FOOD4607             | Packaging and Production    | 14   |  |  |  |
| Compulsory<br>Either | project                     |      |  |  |  |

| F00D1717 | Major Research Project or | 63 |
|----------|---------------------------|----|
| FOOD1727 | Research Project or       | 42 |
| FOOD1737 | Minor Project             | 21 |
|          |                           |    |

\*Credit points may be concentrated in one session.

#### **Elective subjects**

The elective subjects making up the remainder of the credit points 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.

### 8032.4000 Food Science and Nutrition

#### Master of Applied Science MAppSc

The MAppSc course in Food Science and Nutrition is relevant to graduates in science with principal interests in chemistry, biochemistry, physiology and human nutrition. The course comprises a core component (including a project) and an elective component that allows reasonable flexibility and a choice of subjects in human nutrition and food science and technology based on the candidate's background. This new course is still subject to Academic Board approval.

| Compulsory subjects                      |                        |      |  |  |  |  |
|--|------------------------|------|--|--|--|--|
| FOOD1527 Principles of Food Preservation |                        |      |  |  |  |  |
| FOOD1707                                 | Seminar                | 7    |  |  |  |  |
| FOOD3507                                 | Introductory Nutrition | 10.5 |  |  |  |  |
| FOOD3517                                 | Nutrition              | 10.5 |  |  |  |  |

| Compulsory<br>Fither | project                             | CP* |
|----------------------|-------------------------------------|-----|
| F00D1717             | Major Research Project (available   |     |
|                      | only to exceptional candidates) or  | 63  |
| FOOD1727             | Research Project or                 | 42  |
| FOOD1737             | Minor Project                       | 21  |
| Elective sub         | jects                               |     |
| FOOD3527             | Nutritional Evaluation of Foods     | 21  |
| FOOD3537             | Public Health Nutrition             | 7   |
| FOOD3547             | Nutritionally Modified Foods and    |     |
|                      | Ingredients                         | 3.5 |
| FOOD3557             | Advanced Nutritional Science        | 7   |
| CMED9610             | Community Nutrition and Food Policy |     |
| •                    | Studies                             | 10  |
| SLST9250             | Nutrition for Peak Performance      | 15  |
|                      |                                     |     |

\*Credit points may be concentrated in one session.

#### 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.

The course is a blend of formal lectures and laboratory work at the undergraduate and graduate levels. The Graduate Diploma in Food Technology (GradDip) is awarded on the successful completion of one year of full-time study (at least119 credit points, 3.5 credit points equals 1 hour of class contact per week for one session), or two years of part-time study (at least 59.5 credit points/year). It involves the following program:

| Compulsory subjects |                                 |      |  |  |
|---------------------|---------------------------------|------|--|--|
| FOOD1527            | Principles of Food Preservation | 21   |  |  |
| FOOD1537            | Plant Food Products             | 7    |  |  |
| FOOD1547            | Animal Food Products            | 10.5 |  |  |
| FOOD1557            | Food Technology Laboratory      | 21   |  |  |
| FOOD2517            | Food Microbiology               | 14   |  |  |

Students who have previously studied compulsory subjects or their equivalent at an acceptable level may be granted an exemption by the Head of Department but the equivalent number of credit points must be completed by taking other approved subjects.

\*Credit points may be concentrated in one session.

#### Elective subjects

The elective subjects making up the remainder of the credit points, 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. Only graduate subjects will count towards credit points.

## **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.

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

#### APSE0002

Social Issues in Applied Science Staff Contact: Faculty Office CP7.5 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.

#### **BIOT3011**

Biotechnology A Staff Contact: Dr D Glenn CP15 S1 L3 T3 Prerequisite: BIOC2101 and BIOC2201

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 sterilisation; 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 CP15 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 optimisation 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 F Foong, Dr D Glenn CP15 S1 L2 T4 Prerequisites: BIOS2011, BIOS2021, BIOC2101, BIOC2201 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 transposible 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: Dr D Glenn CP7.5 S1 L3

Prerequisites: BIOC210, BIOC2201 and MICR2218

Lecture component of BIOT3011 Biotechnology A.

#### **BIOT3051**

Biotechnology Laboratory Staff Contact: Dr D Glenn CP7.5 S1 T3 Prerequisite: BIOT3041

Laboratory component of BIOT3011 Biotechnology A and a project set within the department to complement the laboratory component.

#### **BIOT3061**

Monoclonal Antibody and Genetic Techniques in Biotechnology Staff Contact: Dr S Mahler CP15 S2 L2 T4 Prerequisite: BIOC2101 and BIOC2201

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 CP 5 SS 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 optimisation and waste disposal. Demonstrations of the operation and control of fermenter systems and of microbial process simulation.

#### BIOT4053

Research Project Staff Contact: Dr S Mahler CP90 F T18

The experimental investigation of some aspects of biotechnology.

### BIOT4063

Research Project Staff Contact: Prof P Rogers/Dr C Marquis CP30 S1 T2 S2 T10

The experimental investigation of some aspects of bioprocess engineering.

#### BIOT4073/BIOT4083

Biotechnology Honours Staff Contact: Prof N Dunn CP120/60

Advanced formal training in selected areas of biotechnology and participation in one of the school's research projects.

#### **BIOT4093**

Biological Process Engineering Staff Contact: Dr C Marquis CP30 F L2 T4 Prerequisite: MICR2201

This course includes coursework material in bioprocess engineering principles, aspects of food engineering and modern biotechnology techniques. Also incorporated in this subject is a practical component. Bioprocess engineering principles covered include basic matabolic pathways, stoichiometry and kinetics of growth and product formations, heat balances, secondary metabolic productions and structural kinetic models, sterilisation, oxygen mass transfer, mixing, instrumentation, downstream processing, legal and ethical issued related to biotechnology products. Food engineering areas covered include the application of modelling techniques to drying and heat transfer. Modern biotechnology methods covered include a variety of methods to generate and characterise production of monoclonal antibodies including hybridoma production, recombinant methods and phage display of antibodies.

#### **BIOT5013**

Practical Biotechnology Staff Contact: Prof P Rogers CP30 F T6

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

#### BIOT7010

Reading List in Biotechnology (Microbiology) Staff Contact: Prof N Dunn CP12 S1 or S2 T3

#### **BIOT7020**

Reading List in Biotechnology (Biochemistry) Staff Contact: Prof N Dunn CP12 S1 or S2 T3

#### **BIOT7030**

Advanced Biotechnology Staff Contact: Dr F Foong CP24 F HPW3 Co-requisite: PHPH5471

This course will cover the production and characterisation of biopharmaceuticals. Production involving chemical and enzymatic peptide synthesis, recombinant production in *E.coli*, yeast, baculovirus and mammalian cells and associated purification processes will be covered. Regulatory considerations important in the validation of fermentation and recovery processes, the purity of final product, and the design of facilities will also be covered. Patent issues relevant to such products and other aspects of licensing business considerations will be addressed, as will case studies of current production processes.

#### **BIOT7040**

Biotechnology Principles Staff Contact: Dr S Mahler CP32 S1 6 S2 2

This course is designed to provide students who have not previously studied biotechnology with sufficient training in the field to complete the MAppSc (Biopharmaceuticals). Aspects of the application of gene cloning techniques for the production of recombinant proteins from a range of host cells, growth, product formation and recovery of microbial products, bioreactor design and operation, monoclonal antibody and gene probe technology will be covered.

#### BIOT7050

Biopharmaceuticals Project (Major) Staff Contact: Dr S Mahler CP64 F HPW 8

An experimental or technical investigation or design project in the general field of biotechnology.

#### BIOT7051

Applied Genetics Staff Contact: Dr D Glenn CP20 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.

Recombinant-DNA technology: plasmid and virus technology; cloning vectors for use in microorganisms, plant and animal cells. Strain construction using recDNA

techniques. Properties of expression, excretion and genetic stability of constructs.

#### BIOT7060

Biopharmaceuticals Project (Minor) Staff Contact: Dr S Mahler CP32 F HPW 4

A small experimental or design project, or an extensive literature review and analysis of a selected topic in biotechnology.

#### BIOT7061

Peptide and Protein Technology Staff Contact: Dr F. Foong CP20 S1 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; immobilisation 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 CP20 S1 L2 T3

Design of bioreactors; range of biocatalysts from free enzymes to immobilised cells; heat and mass transfer, scale-up, 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 computer-linked systems; mathematical simulation.

Detailed examples of bioprocesses including: amino acid production, single cell protein and liquid fuels, secondary metabolite production, growth and product formation of animal and plant tissue cultures. Patent and commercial aspects of bioprocesses.

#### BIOT7081

#### Environmental Biotechnology

Staff Contact: Department Office CP20 S2 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: Dr F Foong CP20 S2 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 F Foong CP12 S1 L3

A study of the characteristics of living systems. Biological molecules: carbohydrates, lipids, proteins and nucleic acids. Cell structure and function: prokaryotic and eukaryotic cells. Basic biochemistry: thermodynamics and catalysis of metabolism; catabolic and anabolic processes; properties of enzymes; DNA replication; protein synthesis. Comparative metabolism of viruses, bacteria, fungi, plants and animals. Metabolic regulation. Modes of nutrition and nutrient cycles. Reproduction and genetics: eukaryotic and prokaryotic systems; sexual and asexual reproduction; bacterial genetics; recombinant DNA technology. Basic plant biology; plant structure and functin; transport. Invertebrate zoology, evolution and animal behaviour. Microorganisms of commercial significance. Biodeterioration and biodegradation.

#### BIOT7110

Bioengineering Principles Staff Contact: Prof P Rogers

CP12 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.

#### BIOT7123 Biotechnology Project (Minor) Staff Contact: Prof P Rogers CP32 F T4

A small experimental or design project, or an extensive literature review or analysis of a selected topic in biotechnology. As part of their project students must satisfactorily complete a training program in research techniques. Part-time students and students carrying out an approved project externally may substitute an appropriate, alternative training program.

#### BIOT8010

Graduate Seminars Staff Contact: Department Office CP8 F T2

#### FOOD1100 Food in Society

Staff Contact: Dr JE Paton CP5 S2 L2 Note/s: Excluded GENA6201. Interactive discussion sessions held during lectures.

Introduction to principles of food production and consumption. Food in history, society, economics and politics. Development of the food industry into one of the largest industry sectors in Australia; nutritional, physiological and psychological roles of food; role of microbiology, biotechnology and technology in safe, nutritious, innovative food processing. Topical issues discussed include: food irradiation risk or benefit?; genetic engineering and biotechnology 'new' food sources; food additives necessity or evil?; environmental impact of food processing; food choices and prejudices and food marketing and education who should the consumer believe?

#### FOOD1310

Food Preservation Staff Contact: Prof KA Buckle CP15 S1 L3 T3 Prerequisites: BIOC2101, BIOC2201, 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, ionising 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 JE Paton CP5 S1 L2 Prerequisites: BIOC2101, BIOC2201, 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 post-harvest physiology, storage and handling. *Lipids:* Sources and composition of fats and oils, methods of extraction and processing. *Non-microbial 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 JE Paton CP7.5 S1 L3 Prerequisites: BIOC2101, BIOC2201, 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, marinading 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 CP5 S2 L1 T1 Prerequisites: 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 JE Paton CP15 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: Dr RH Driscoll CP40 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.

#### FOOD1410

Field Excursions Staff Contact: Prof KA Buckle CP7.5 S1 T3 Prerequisite: Completion of Year 3 subjects

Inspection of food processing plants, growing areas and research stations in the Sydney metropolitan area, New South Wales and interstate.

#### FOOD1420

Food Legislation Staff Contact: Prof KA Buckle CP5 S1 L2 Prerequisite: Completion of Year 3 subjects

An overview of Federal and State regulations affecting the production, marketing, advertising and sale of foods. Food imports and exports. Mechanisms for development of food standards. Principles of approval and usage of food additives; toxicological evaluation of food additives. Codex standards. Implementation of food regulations. Regulatory aspects of new food biotechnologies.

#### FOOD1430

Food Industry Management

Staff Contact: Dr M Filadelfi-Keszi CP5 S1 L2

Prerequisite: Completion of Year 3 subjects

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

#### FOOD1440

Food Quality and Product Development

Staff Contact: Dr M Filadelfi-Keszi CP15 S2 L2 T4

Prerequisite: Completion of Year 3 subjects

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.

#### FOOD1450

Food Processing Wastes Staff Contact: Prof KA Buckle CP7.5 S2 L2 T1 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 utilisation of wastes from food processing operations. Legal and economic aspects of waste disposal. Inspections of water and waste treatment plants.

#### FOOD1460 Cereal Technology

Staff Contact: A/Prof M Wootton CP15 S2 L2 T4 Prerequisite: FOOD1350

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, properties and behaviour. Wheat variety identification. Meat/cereal combinations. Cereal enzymes. Non-food uses of cereals. Preparation and uses of cereal protein, starches and lipids.

#### FOOD1470

Postharvest Technology of Foods Staff Contact: Dr JE Paton CP15 S1 L2 T4 Prerequisite: FOOD1350

Pre-harvest considerations. Postharvest physiology and biochemistry. Postharvest factors affecting quality. Methods of storage and handling. Marketing strategies for selected food commodities.

#### FOOD1507

#### Introductory Food Science

Staff Contact: Prof KA Buckle CP7 S1 L1 S2 T1

An introduction to the history of food preservation and human nutrition. Current world food patterns, organisations 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 KA Buckle CP10.5 S1 or S2 L2 T1

An introduction to the chemical, physical and biochemical properties of foods. Food proteins, lipids, carbohydrates, nucleic acids, vitamins, minerals, pigments. Food enzymes, main classes and factors affecting their activity. Food rheology and texture. Heat transfer in foods. Effect of processing upon the properties of foods. Basic techniques for the analysis of food components and properties.

#### FOOD1527

Principles of Food Preservation Staff Contact: Prof KA Buckle CP21 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, ionising 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 JE Paton CP7 S1 L2

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 post-harvest physiology, storage and handling. *Lipids*: sources and composition of fats and oils, methods of extraction and processing. *Non-microbial 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.

#### FOOD1547

Animal Food Products Staff Contact: Dr JE Paton CP10.5 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, marinading 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 JE Paton

CP21 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: A/Prof M Wootton CP7 S2 L2 Prerequisite: FOOD1537 or equivalent

World production of cereals: cultivation, diseases, harvesting and storage of cereal crops. Grain morphology and components, cereal quality, quality and yield improvements by breeding. Milling of wheat, flour types, flour testing, suitability for different purposes, flour component interactions in doughs, flour bleachers and dough improvers, baking technology. The use of non-wheat flours in bread and baked goods. Pasta products and breakfast cereals. Nutritional aspects of cereals. Starch-gluten separation, starch syrups. Malting, brewing, distilling and industrial alcohol production from cereals. Preparation, properties and uses of modified starches.

#### FOOD1637

Marine Products Staff Contact: Prof KA Buckle CP7 S2 L2 Prerequisite: FOOD1547 or equivalent

World fisheries, oceanographic factors and fish populations. Biochemistry and microbiology of growth, culture, harvesting and post-harvest handling. Cultivation of fish, molluscs, crustacea, modern and traditional methods. Biochemistry and microbiology of marine products in relation to freezing and preservation by the use of heat, chemicals and fermentation. Quality control parameters and fish inspection. Role of marine products in world nutrition. Possibilities for further exploitation of marine resources.

#### FOOD1647

Food Additives and Toxicology Staff Contact: A/Prof M Wootton CP7 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 JE Paton CP21 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 non-climacteric 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 post-harvest tissue; physical and chemical methods of control; post-harvest disinfestation and quarantine measures. Examination of current commercial storage and marketing operations.

#### FOOD1667

Postharvest Storage of Foods Staff Contact: Dr JE Paton CP21 S1 L2 T4 Prerequisite: FOOD1557 or equivalent

Pre-harvest considerations, post-harvest physiology and biochemistry, post-harvest factors affecting quality, methods of storage and handling, marketing strategies for selected food commodities.

### FOOD1707

Seminar

Staff Contact: A/Prof H Greenfield CP7 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 KA Buckle CP63 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 KA Buckle CP42 F T6

An investigation of an aspect of food science and technology and submission of a project report.

#### FOOD1737

Minor Project Staff Contact: Prof KA Buckle CP21 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 KA Buckle CP21 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 gualified students.

#### FOOD1757

Special Topics in Food Science and Technology Staff Contact: Prof KA Buckle CP10.5 S1 or S2 T3

An investigation similar to but shorter than that outlined in FOOD1747.

#### FOOD1767

Reading Assignment Staff Contact: Prof KA Buckle CP3.5 SS T1

A reading assignment in an area supporting candidates' major disciplines or commodity interests. Presentation of a seminar may be required.

#### FOOD2310

Food Microbiology Staff Contact: Prof GH Fleet CP10 S1 L2 T2 Prerequisite: MICR2218

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 food-borne 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; sub-lethal injury; standard methods for determination of total plate counts, indicator organisms, food-borne pathogenic species, principal spoilage species. Microbiological quality assurance: specifications and standards; decision criteria; hazard analysis and critical control point (HACCP) concept; cleaning and sanitation.

#### FOOD2410

#### Advanced Food Microbiology Staff Contact: Prof GH Fleet CP15 S2 L2 T4 Prerequisite: FOOD2310

An advanced theoretical and practical treatment of the ecology, taxonomy, biochemistry and analytical technology of bacteria, yeasts, fungi and viruses associated with food spoilage, food-borne 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: Prof GH Fleet CP7.5 S1 L2 T1 Prerequisite: FOOD2310 Note/s: Not offered in 1997.

The ecological, taxonomic and biochemical fundamentals of yeasts. The role of yeasts in alcoholic fermentations: beer, wine, cider, distilled spirits. Baker's yeast production and the role of yeasts in baking. Yeast fermented foods. The spoilage of foods by yeasts. Yeasts and yeast extracts as food for animals and humans. Yeast enzymes in the food industry.

#### FOOD2430

Quality Assurance in Food Microbiology Staff Contact: Dr JM Cox CP5 S1 L1T1 Prerequisite: FOOD2310

Theoretical concepts in, and application of traditional and modern approaches to microbiological quality assurance. HACCP. Cleaning and sanitation. Microbiological criteria and sampling plans. Local, national and international approaches to obtaining safe food. Management and quality assurance in the microbiology laboratory. Quality assurance of microbiological media. FOOD2440 Microbial Food Spoilage Staff Contact: Dr JM Cox CP2.5 S2 L1 Prerequisite: FOOD2310

Detailed consideration of selected microbial groups responsible for spoilage yeasts, moulds, psychrotrophs. Spoilage of specific commodities - dairy products, fruits and vegetables, meat and fish. Impact of new processing and preservation technologies on prevention or modification of food spoilage. Biochemical basis of spoilage. Microbial taints. Predicting shelf-life and spoilage.

#### FOOD2450

Foodborne Microorganisms of Public Health Significance Staff Contact: Dr JM Cox CP5 S2 L2 Prerequisite: FOOD2310

Methods for investigating food poisoning outbreaks. Costs of foodborne disease. In-depth consideration of the ecology, epidemiology, pathogenicity, and topical issues involving bacterial, vira,, parasiticl and fungal foodborne pathogens.

#### FOOD2460

#### Food and Beverage Fermentations Staff Contact: Prof GH Fleet CP5 S2 L2

Prerequisite: FOOD2310

A detailed treatment of the microbial ecology, biochemistry, processing technology and quality parameters of fermented foods and beverages; cheese, yoghurt, 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.

#### FOOD2470

#### Microorganisms as Food Processing Aids and Ingredients Staff Contact: Prof GH Fleet

CP2.5 S2 L1 Prerequisite: FOOD2310

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, immobilised cell and cell reactor technologies for conducting food beverage bioconversions.

#### FOOD2507

Introductory Microbiology Staff Contact: Prof GH Fleet CP14 S1 L2 T2 Note/s: Not offered in 1997.

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: Prof GH Fleet

CP14 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; sub-lethal 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: Prof GH Fleet CP21 S2 L2 T4

Prerequisite: FOOD2517 or equivalent

Detailed lecture and laboratory consideration of standard methods and new methods and technologies for the analysis of bacteria, yeasts and fungi in foods. Rapid cultural methods; immunoassay, DNA-probe, impedance, bioluminescence, image analysis,epifluorescence (DEFT), Petrifilm, computer identification of microorganisms. Measurement of cleaning and sanitation effectiveness. Sampling considerations. Interpretation of microbiological data in reference to specifications, standards, spoilage and public health risk. Detection and enumeration of specific microorganisms using new technologies.

#### FOOD2537

#### Microbiological Quality Assurance Staff Contact: Dr JM Cox CP7 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: Prof GH Fleet CP21 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 JM Cox CP3.5 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 JM Cox CP7 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: Prof GH Fleet CP7 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: Prof GH Fleet CP3.5 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 shelflife, as agents to improve the nutritive and therapeutic value of foods, immobilised cell and cell reactor technologies for conducting food and beverage bioconversions.

#### FOOD2597

Food Microbiology Seminar Staff Contact: Dr JM Cox CP7 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: Prof GH Fleet CP42 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: Prof GH Fleet CP63 F T9

A detailed investigation of a selected topic in food microbiology involving a literature survey, experimental work and submission of a project thesis.

#### FOOD3210

Introductory Nutrition Staff Contact: A/Prof H Greenfield CP7.5 S1 L2 T1 Co or Prerequisite: BIOC2101, BIOC2201

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 CP7.5 S2 L2 T1 Prerequisites: BIOC2101, BIOC2201, 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 under-nutrition 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 bases.

#### FOOD3410

Nutrient Analysis of Foods Staff Contact: Dr J Arcot CP15 S1 L2 T4 Prerequisite: FOOD3310 or equivalent

Principles of nutrient analysis of foods by chemical and biospecific procedures. Sampling, quality assurance of analytical results, data scrutiny and compilation. Practical exercises in nutrient analysis of foods using bench, instrumental and biospecific techniques.

#### FOOD3420 Population and Applied Nutrition Staff Contact: A/Prof H Greenfield

CP5 S2 L2

Prerequisite: FOOD3310 or equivalent

Structure of the population. Food supplies, food consumption, food and nutrition policy, nutritional epidemiology. Population dietary references such as food balance sheets, nutrition monitoring and surveillance, dietary reference values. Food programs such as food fortification, supplementary feeding schemes, nutritional rehabilitation, nutritionally modified foods, nutritional regulations and standards, nutrition education, dietary and other nutrition interventions (ORT, family planning, infection control, growth monitoring). Principles and practice of applied nutrition programs. Evaluation of applied nutrition programs.

#### FOOD3430

### Special Dietary Foods and Ingredients Staff Contact: Dr J Arcot

CP2.5 S2 L1

Special dietary and nutritionally modified foods. Modified viscosity foods, low allergen foods. Infant formulas, processed weaning foods, parenteral feeds, invalid foods, sports beverages. Intense sweeteners, fibrous ingredients, amino acids, micronutrients, fat replacers. Functional foods. Regulations and processes for nutritionally-modified foods.

#### FOOD3507

Introductory Nutrition Staff Contact: A/Prof H Greenfield CP10.5 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 CP10.5 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 under-nutrition 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

Nutritional Evaluation of Foods Staff Contact: Dr J Arcot CP21 S1 L2 T4 Prerequisite: FOOD3517 or equivalent

Principles of nutrient analysis of foods by chemical and biospecific procedures. Sampling, quality assurance of analytical results, data scrutiny and compilation. Practical exercises in nutrient analysis of foods using bench, instrumental and biospecific techniques. Literature search.

### FOOD3537

Public Health Nutrition Staff Contact: A/Prof H Greenfield

CP7 S2 L2 Prerequisite: FOOD3527 or equivalent

Structure of the population. Food supplies, food consumption, food and nutrition policy, nutritional epidemiology. Population dietary references such as food balance sheets, nutrition monitoring and surveillance, dietary reference values. Food programs such as food fortification, supplementary feeding schemes, nutritional rehabilitation, nutritionally modified foods, nutritional regulations and standards, nutrition education, dietary and other nutrition interventions (ORT, family planning, infection control, growth monitoring). Principles and practice of applied nutrition programs. Evaluation of applied nutrition programs. Project work.

#### FOOD3547

Nutritionally Modified Foods and Ingredients Staff Contact: Dr J Arcot CP3.5 S2 L1 Prerequisite: FOOD3517 or equivalent

Special dietary and nutritionally modified foods. Modified viscosity foods, low allergen foods. Infant formulas, processed weaning foods, parenteral feeds, invalid foods, sports beverages. Intense sweeteners, fibrous ingredients, amino acids, micronutrients, fat replacers. Functional foods. Regulations and processes for nutritionally-modified foods. Literature search.

#### FOOD3557

Advanced Nutritional Science Staff Contact: A/Prof H Greenfield CP7 S2 T2 Prerequisite: FOOD3527 or equivalent

Selected advanced topics e.g. nutrient bioavailability studies, nitrogen balance tests, vitamin load tests, sodium and potassium excretions, creatinine excretions, physical activity diaries, fitness assessment, biochemical assessment, design and evaluation of nutritional epidemiology studies, food intake studies, duplicate diet analyses.

#### FOOD4210

Introductory Food Engineering Staff Contact: Dr JL Paterson CP7.5 S1 L2 T1

Prerequisites: PHYS1002 or PHYS1022 and MATH1141 and MATH1241 or MATH1131 and MATH1231 or MATH1042 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.

#### FOOD4310

Food Process Engineering Staff Contact: Dr RH Driscoll CP10 S2 L2 T2 Prerequisite: FOOD4210

Refrigeration, freezing, chilling and thawing. Evaporation; dehydration. Extraction. Distillation. Extrusion. Comminution. Filtration and separation. Process control. Packaging.

#### FOOD4320

**Computer Applications** Staff Contact: Dr RH Driscoll CP5 S2 L1 T1 Prerequisite: MATH2819

Introduction to the DOS operating system and WINDOWS. The use of statistical, graphics and other program packages to solve problems in food science and technology.

#### FOOD4420

Food Packaging Staff Contact: Dr JL Paterson CP7.5 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 RH Driscoll CP7.5 S1 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 RH Driscoll CP7.5 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.

#### FOOD4507

#### Food Engineering Principles

Staff Contact: Dr JL Paterson

CP10.5 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 RH Driscoll CP14 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 RH Driscoll CP7 S2 L1 T1 Prerequisite: An introductory statistics subject or equivalent Introduction to the DOS operating system and WINDOWS. The use of statistical, graphics and other program packages to solve problems in food science and technology.

#### FOOD4557

Food Engineering Laboratory Staff Contact: Dr JL Paterson CP10.5 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 JL Paterson CP10.5 S3 T1.5

Inspection of food processing factories, agricultural and food research establishments and food producing areas.

#### FOOD4587

Advanced Food Engineering A Staff Contact: Dr RH Driscoll CP14 S1 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 RH Driscoll CP14 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 JL Paterson CP14 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.

#### FOOD9410

Honours Research Project Staff Contact: Dr JM Cox CP100 S3

An extensive research project on some aspects of food science and technology, including preparation of a literature review, conduct of laboratory-based research, presentation of two seminars, and submission of a thesis based on the results of the research project. Candidates will undertake corequisite formal coursework as approved by the Head of Department.

# School of Chemical Engineering and Industrial Chemistry

Head of School Professor DL Trimm

#### Administrative Officer Ms KM Mason

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 in conjunction with the School of Mines and School of Materials Science and 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 utilisation of fuels and energy.

Industrial Chemists are applied scientists, some of whom are engaged in solving problems in forefront reseach areas while others are responsible for the successful operations of Australia's chemical industry.

Industrial Chemists analyse raw materials, apply computers to the simulation and control of chemical plant and verify the quality of the product. A particularly important activity is the control and management of the environment of industrial processes. Industrial Chemists are capable of fulfilling a multiplicity of roles - as research scientists, development chemists, technical representatives and as plant/company managers.

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.

# **Undergraduate Study**

Students are expected to possess a calculator having exponential capabilities (In 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.

HPW

C4 C0

CP

### **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.

With one additional year of study, it is possible, upon completion of the Petroleum Engineering program **3045**, to obtain a double BE degree in Petroleum and Chemical Engineering **3046** because the first two years of the Petroleum Engineering course are identical to the first two years of the Chemical Engineering course.

110144

CD

|                     |                       | S1 | S2 | UF  |
|---------------------|-----------------------|----|----|-----|
| Year 1              |                       |    |    |     |
| CHEM1101            | Chemistry 1A          | 6  | 0  | 15  |
| CHEM1201            | Chemistry 1B          | 0  | 6  | 15  |
| CHEN1020            | Engineering 1 CE+     | 6  | 6  | 30  |
| MATH1131            | Mathematics 1A or     |    |    |     |
| MATH1141            | Higher Mathematics 1A | 6  | 0  | 15  |
| MATH1231            | Mathematics 1B or     |    |    |     |
| MATH1241            | Higher Mathematics 1B | 0  | 6  | 15  |
| PHYS1002            | Physics 1             | 6  | 6  | 30  |
| General Edu         | cation subject/s      | 0  | 2  | 7.5 |
| <b>Total HPW S</b>  | Session 1 24          |    |    |     |
| <b>Total HPW S</b>  | Session 2 26          |    |    |     |
| <b>Total Credit</b> | Points 127.5          |    |    |     |

|                       |                              | 31  | 32  |     |
|-----------------------|------------------------------|-----|-----|-----|
| Year 2                |                              |     |     |     |
| CEIC2010              | Instrumental Analysis        | 3   | 3   | 15  |
| CEIC2020              | Computing                    | 1   | 2   | 7.5 |
| CEIC2030              | Applied Thermodynamics       |     |     |     |
|                       | and Rate Processes           | 2.5 | 0   | 6.5 |
| CEIC2040              | Applied Electrochemical and  |     |     |     |
|                       | Surface Processes            | 1.5 | 0   | 4   |
| CHEM2828              | Organic and Inorganic        |     |     |     |
|                       | Chemistry                    |     |     |     |
|                       | (for Chemical Engineers)     | 4   | 0   | 10  |
| CHEN2010              | Material and Energy Balances | 2   | 2   | 10  |
| CHEN2020              | Flow of Fluids               | 2   | 2   | 10  |
| CHEN2030              | Heat Transfer                | 0   | 3   | 7.5 |
| CHEN2040              | Mass Transfer Fundamentals   | 0   | 2   | 5   |
| CHEN2050              | Chemical Engineering         |     |     |     |
|                       | Laboratory 1                 | 1   | 2   | 7.5 |
| ELEC0807              | Electrical Engineering1E     | Ó   | 3   | 7.5 |
| INDC2050              | Physical Process Laboratory  | 2   | ō   | 5   |
| MATH2021              | Mathematics 2                | 2   | 2   | 15  |
| MATH2819              | Statistics SA                | 2   | 2   | 10  |
| General Educ          | ation subject/s              | 5   | 2   | 15  |
| General Luuci         | ation subjects               | ~   | 2   | 15  |
| Total HPW Se          | ession 1 25                  |     |     |     |
| Total HPW Se          | ession 2 25                  |     |     |     |
| Total Credit F        | Points 135.5                 |     |     |     |
|                       |                              |     |     |     |
| Year 3                |                              |     | _   |     |
| CEIC3010              | Reaction Engineering         | 0   | 3   | 7.5 |
| CHEN3010              | Engineering Thermodynamics   | ; 4 | 0   | 10  |
| CHEN3020              | Numerical Methods            | 0   | 3   | 7.5 |
| CHEN3030              | Fluids 2                     | 2   | 0   | 5   |
| CHEN3040              | Separation Processes 1       | 2   | 2   | 10  |
| CHEN3050              | Particle Mechanics           | 0   | 3   | 7.5 |
| CHEN3060              | Process Plant Engineering 1  | 4   | 4   | 20  |
| CHEN3070              | Process Control              | 0   | 2   | 5   |
| CHEN3080              | Chemical Engineering         |     |     |     |
|                       | Laboratory 2                 | 1.5 | 1.5 | 7.5 |
| CHEN3090              | Chemical Engineering         |     |     |     |
| 0                     | Applications                 | 4   | 4   | 20  |
| CIVI 0616             | Structures                   | 3   | ò   | 7.5 |
| MATH3021              | Mathematics                  | 2   | ž   | 15  |
| General Educ          | ation subject/s              | 2   | ō   | 7.5 |
|                       |                              | -   | v   |     |
| Total HPW Se          | ession 1 24.5                |     |     |     |
| Total HPW Se          | ession 2 24.5                |     |     |     |
| <b>Total Credit F</b> | Points 130                   |     |     |     |

|                          |                          | HP<br>S1 | W<br>S2 | СР   |
|--------------------------|--------------------------|----------|---------|------|
| Year 4                   |                          |          |         |      |
| APSE0002                 | Social Issues in Applied | 2        | 0       | 5    |
|                          | Separation Processes 2*  | 2        | ŏ       | 5    |
| CHEN4020                 | Advanced Beaction        | -        | Ŭ       | •    |
| 0112114020               | Engineering*             | 2        | 0       | 5    |
| CHEN4030                 | Environmental Pollution  |          |         |      |
|                          | Control*                 | 2        | 0       | 5    |
| CHEN4070                 | Process Dynamics and     | ~        | ~       | 40 5 |
|                          | Control                  | 3        | 2       | 12.5 |
| CHEN4081                 | Design Project           | 3        | 3       | 15   |
| CHEN4090                 | Research Project*        | 2        | 10      | 30   |
| CHEN4100                 | Professional Electives*  | 3        | 3       | 15   |
| CHEN4110                 | Process Analysis and     |          |         |      |
|                          | Synthesis                | 1.5      | 1.5     | 7.5  |
| CHEN4120                 | Process Plant Management |          |         |      |
|                          | and Operations*          | 3        | 3       | 15   |
| Total HPW Session 1 23.5 |                          |          |         |      |
| Total HPW Session 2 22.5 |                          |          |         |      |
| Total Credit I           | Points 115               |          |         |      |

\*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 General Education Requirement.

### **Main Electives**

#### Fuel and Energy Engineering

The Department of Fuel Technology offers a professional elective in Fuel and Energy Engineering designed for those students interested in the application in the fourth year of the course.

Students choosing this professional elective should take the subjects listed in the table below in lieu of CHEN4010, CHEN4020, CHEN4030, CHEN4100, CHEN4120.

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

| Year 4   |   |    |      |
|----------|---|----|------|
| CHEN4121 | 5 | 0  | 12   |
| FUEL4010 | 9 | 4  | 32.5 |
| FUEL4090 | 2 | 10 | 30   |

#### **Minerals Engineering**

Jointly run 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.

Students choosing this elective should take the required subjects listed in the table below for Year 4 in lieu of the following subjects: CHEN4010 Separations 2, CHEN4020 Advanced Reaction Engineering, CHEN4030 Safety and Environmental, CHEN4100 Professional Electives and CHEN4120 Process Plant Management and Operations.

This elective may qualify graduates for membership of the Australian Institute of Mining and Metallurgy.

|          |                              | HF<br>S1 | PW<br>S2 | СР   |
|----------|------------------------------|----------|----------|------|
| Year 4   |                              |          |          |      |
| CHEN4121 | Process Plant Management     |          |          |      |
|          | and Safety                   | 5        | 0        | 12.5 |
| GEOL5410 | Mineralogy for Mineral       |          |          |      |
|          | Engineering                  | 0        | 2        | 5    |
| MATS9650 | Pyrometallurgical Processes  | 0        | 2        | 5    |
| MINP4020 | Hydrometallurgy Practices    | 3        | 0        | 7.5  |
| MINP4030 | Hydrometallurgical Process   |          |          |      |
|          | Engineering                  | 0        | 2        | 5    |
| MINE4101 | Mineral Processing Practices | 2        | 0        | 5    |
| MINE4401 | Mine Waste Disposal and the  | ;        |          |      |
|          | Environment                  | 0        | 2        | 5    |
|          |                              |          |          |      |

#### 3050

#### **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.

#### Stage 1

| MATH1131              | Mathematics 1A or           |     |   |     |
|-----------------------|-----------------------------|-----|---|-----|
| MATH1141              | Higher Mathematics 1A       | 6   | 0 | 15  |
| MATH1231              | Mathematics 1B or           |     |   |     |
| MATH1241              | Higher Mathematics 1B       | 0   | 6 | 15  |
| PHYS1002              | Physics 1                   | 6   | 6 | 30  |
|                       |                             |     |   |     |
| Total HPW Se          | ession 1 12                 |     |   |     |
| Total HPW Se          | ession 2 12                 |     |   |     |
| Total Credit P        | Points 60                   |     |   |     |
|                       |                             |     |   |     |
| Stage 2               |                             |     |   |     |
| CHEN1020              | Engineering 1CE             | 6   | 6 | 30  |
| CHEM1101              | Chemistry 1A                | 6   | 0 | 15  |
| CHEM1201              | Chemistry 1B                | 0   | 6 | 15  |
| General Educa         | ation subject/s             | 2   | 0 | 7.5 |
|                       | ,                           |     |   |     |
| Total HPW Se          | ession 1 14                 |     |   |     |
| Total HPW Se          | ession 2 12                 |     |   |     |
| <b>Total Credit F</b> | Points 67.5                 |     |   |     |
|                       |                             |     |   |     |
| Stage 3               |                             |     |   |     |
| CEIC2010              | Instrumental Analysis       | 3   | 3 | 15  |
| CEIC2020              | Computing                   | 1   | 2 | 7.5 |
| CEIC2030              | Applied Thermodynamics and  | 1   |   |     |
|                       | Rate Processes              | 2.5 | 0 | 6.5 |
| CEIC2040              | Applied Electrochemical and |     |   |     |
|                       | Surface Processes           | 1.5 | 0 | 4   |
| ELEC0807              | Electrical Engineering 1E   | 0   | 3 | 7.5 |
| INDC2050              | Physical Processes          |     |   |     |
|                       | Laboratory                  | 2   | 0 | 5   |
| MATH2021              | Mathematics                 | 2   | 2 | 15  |
| MATH2819              | Statistics SA               | 2   | 2 | 10  |
|                       |                             |     |   |     |
| Total HPW Se          | ession 1 14                 |     |   |     |
| Total HPW Se          | ession 2 12                 |     |   |     |
| Total Credit F        | Points 70.5                 |     |   |     |
|                       |                             |     |   |     |

|   |   | HP<br>S1 | W<br>S2 | СР       |
|---|---|----------|---------|----------|
| Stage 4<br>CHEM2828   | Organic and Inorganic                           |          | _       |          |
| CHEN2010  | Chemistry<br>Material and Energy                | 4        | 0       | 10       |
|   | Balances<br>Flow of Fluids                      | 2        | 2       | 10       |
| CHEN2020<br>CHEN2030  | Heat Transfer                                   | õ        | 3       | 7.5      |
| CHEN2040  | Mass Transfer Fundamentals                      | 0        | 2       | 5        |
| OHENZOU   | Laboratory I                                    | 1        | 2       | 7.5      |
| General Educa   | ation subject/s                                 | 2        | 2       | 7.5      |
| Total HPW Se<br>Total HPW Se<br>Total Credit P                        | ession 1 11<br>ession 2 13<br>Points 57.5       |          |         |          |
| Stage 5   |   |          |         |          |
| CHEN3010<br>CHEN3020  | Engineering Thermodynamics<br>Numerical Methods | 4<br>0   | 0       | 10<br>75 |
| CHEN3050  | Particle Mechanics                              | õ        | 3       | 7.5      |
| CHEN3090  | Chemical Engineering<br>Applications            | 4        | 4       | 20       |
| CIVL0616  | Structures                                      | 3        | 0       | 7.5      |
|   | Mainematics                                     | 2        | 2       | 15       |
| Total HPW Se<br>Total HPW Se<br>Total Credit P                        | ession 1 12<br>ession 2 12<br>Points 67.5       |          |         |          |
| Stage 6<br>CEIC3010   | Reaction Engineering                            | 0        | 3       | 7.5      |
| CHEN3030  | Fluids II                                       | 2        | 0       | 5        |
| CHEN3040<br>CHEN3060  | Process Plant Engineering I                     | 2        | 2<br>4  | 20       |
| CHEN3070<br>CHEN3080  | Process Control                                 | 0        | 2       | 5        |
|   | Laboratory II                                   | 1.5      | 1.5     | 7.5      |
| General Educa   | ation subject/s                                 | 2        | 0       | 7.5      |
| Total HPW Session 111.5Total HPW Session 212.5Total Credit Points62.5 |   |          |         |          |

### 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 and the Institution of Engineers, Australia 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.

|                          |                              | HP<br>S1 | W<br>S2 | СР  |
|--------------------------|------------------------------|----------|---------|-----|
| Year 1                   |                              | 5,       | 52      |     |
| CHEM1101                 | Chemistry 1A                 | 6        | 0       | 15  |
| CHEM1201                 | Chemistry 1B                 | 0        | 6       | 15  |
| MATH1131                 | Engineering 1 C <sup>*</sup> | ь        | ю       | 30  |
| MATH1141                 | Higher Mathematics 1A        | 6        | 0       | 15  |
| MATH1231                 | Mathematics 1B or            |          |         |     |
| MATH1241                 | Higher Mathematics 1B        | 0        | 6       | 15  |
| PHYS1002                 | Physics 1                    | 6        | 6       | 30  |
| Total HPW Se             | ession 1 24                  |          |         |     |
| Total HPW Se             | SSION 2 24<br>Dointe 120     |          |         |     |
| Total Credit P           |                              |          |         |     |
| Year 2                   |                              |          |         |     |
| CEIC2010                 | Instrumental Analysis        | 3        | 3       | 15  |
| CEIC2020                 | Computing                    | 1        | 2       | 7.5 |
| CEIC2030                 | and Bate Processes           | 25       | 0       | 65  |
| CEIC2040                 | Applied Electrochemical and  | 2.0      | Ŭ       | 0.0 |
|                          | Surface Processes            | 1.5      | 0       | 4   |
| CHEM2021                 | Organic Chemistry            | 2        | 4       | 15  |
| CHEM2031                 | Inorganic Chemistry          | 0        | 6       | 15  |
| INDC2010                 | Mass and Energy Balances     | 2        | 0       | 5   |
| INDC2020                 | Heat Transfer and            | 2        |         | 7.5 |
|                          | Temperature Measurement      | 0        | 2       | 5   |
| INDC2050                 | Physical Processes           |          |         |     |
|                          | Laboratory                   | 2        | 0       | 5   |
| MATH2021                 | Mathematics                  | 2        | 2       | 15  |
| PHYS2920                 | Flectronics                  | 2        | 2       | 75  |
| General Educa            | ation subject/s              | ŏ        | 2       | 7.5 |
| Total HPW Se             | ession 1 23                  |          |         |     |
| Total HPW Se             | ession 2 24                  |          |         |     |
| Total Credit F           | Points 125.5                 |          |         |     |
| Vear 3                   |                              |          |         |     |
| BIOT3100                 | Fermentation Processes       | 2        | 0       | 5   |
| CEIC3010                 | Reaction Engineering         | 0        | 3       | 7.5 |
| CEIC4010                 | Process Economics 1          | 1        | 0       | 2.5 |
| CHEM3829                 | Organic Chemistry            | 6        | 0       | 15  |
| INDC3010                 | Experimental Design          | 3        | 3       | 7.5 |
| INDC3041                 | Corrosion in the Chemical    | 0        | 3       | 7.5 |
|                          | Industry                     | 0        | 3       | 7.5 |
| INDC3050                 | Chemistry of High            |          |         |     |
|                          | Temperature Materials        | 0        | 2       | 5   |
|                          | Unit Operations              | 2        | 0       | 5   |
| 11003070                 | Control 1                    | 0        | 3       | 75  |
| INDC3080                 | Instrumental Analysis 2      | 4        | õ       | 10  |
| INDC3090                 | Chemistry of Industrial      |          |         |     |
| 0012/00/0                | Processes                    | 3        | 3       | 15  |
| PULY3010<br>General Educ | Polymer Science              | 2        | 4       | 15  |
|                          |                              | 2        | 2       | 15  |
| Total HPW Se             | ession 2 25                  |          |         |     |
| Total Credit F           | Points 125                   |          |         |     |

|  |                            | HF<br>S1 | W<br>S2 | СР   |
|--|----------------------------|----------|---------|------|
| Year 4   |                            |          |         |      |
| APSE0002   | Social Issues in Applied   | -        |         | _    |
|  | Science                    | 2        | 0       | 5    |
| CEIC4020   | Process Economics 2        | 1        | 0       | 2.5  |
| INDC4040   | Management                 | 2        | 0       | 5    |
| INDC4060   | Process Design             | 3        | 4       | 17.5 |
| INDC4070   | Laboratory Automation      |          |         |      |
|  | Science                    | 4        | 0       | 10   |
| INDC4080   | Seminars                   | 2        | 2       | 10   |
| INDC4090   | Project                    | 8        | 16      | 60   |
| INDC4130   | Environmental Chemistry of | Ū        |         |      |
| 11004100   | Industrial Processes       | 2        | Λ       | 5    |
|  | Industrial 1 rocesses      | 2        | 0       | 5    |
|  | Advanced Bolymor Science   | 2        | 0       | 5    |
|  | Advanced Polymer Science   | 2        | Š       | 3    |
| General Educ   | ation subject/s            | 0        | 2       | 7.5  |
| Total HPW Session 126Total HPW Session 224Total Credit Points127.5 |                            |          |         |      |

### 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.

|                     |                       | HF<br>S1 | ₽₩<br>S2 | СР |
|---------------------|-----------------------|----------|----------|----|
| Stages 1 and        | d 2*                  |          |          |    |
| CHĚM1101            | Chemistry 1A          | 6        | 0        | 15 |
| CHEM1201            | Chemistry 1B          | 0        | 6        | 15 |
| INDC1020            | Engineering 1 IC      | 6        | 6        | 30 |
| MATH1131            | Mathematics 1A or     |          |          |    |
| MATH1141            | Higher Mathematics 1A | 6        | 0        | 15 |
| MATH1231            | Mathematics 1B or     |          |          |    |
| MATH1241            | Higher Mathematics 1B | 0        | 6        | 15 |
| PHYS1002            | Physics 1             | 6        | 6        | 30 |
| Total HPW S         | Session 1 24          |          |          |    |
| <b>Total HPW S</b>  | ession 2 24           |          |          |    |
| <b>Total Credit</b> | Points 120            |          |          |    |

\*Physics and Mathematics are usually taken in Stage 1 and the other subjects in Stage 2.

|  |   | HP<br>S1    | W<br>S2     | СР             |
|--|---|-------------|-------------|----------------|
| Stage 3<br>CEIC2010<br>CEIC2030                | Instrumental Analysis                             | 3           | 3           | 15             |
|  | and Rate Processes                                | 2.5         | 0           | 6.5            |
|  | Surface Processes                                 | 1.5         | 0           | 4              |
| INDC2050                                       | Physical Processes<br>Laboratory                  | 2           | 0           | 5              |
| MATH2021<br>MATH2819<br>General Educi          | Mathematics 2<br>Statistics SA<br>ation subject/s | 2<br>2<br>2 | 2<br>2<br>2 | 15<br>10<br>15 |
| Total HPW Se<br>Total HPW Se<br>Total Credit F | ession 1 15<br>ession 2 9<br>Points 70.5          |             |             |                |
| Stage 4  | Computing   | 4           | 2           | 75             |
| CHEM2021                                       | Organic Chemistry                                 | 6           | õ           | 15             |
| CHEM2031                                       | Inorganic Chemistry                               | 0           | 6           | 15             |
| INDC2020                                       | Introduction to Fluid Flow                        | 2           | 1           | 7.5            |
| INDC2010                                       | Mass and Energy Balances                          | 2           | 0           | 5              |
|  | Temperature Measurement                           | 0           | 2           | 5              |
| PH152920                                       | Electronics                                       | 3           | U           | 1.5            |
| Total HPW Se<br>Total HPW Se<br>Total Credit F | ession 1 14<br>ession 2 11<br>Points 62.5         |             |             |                |
| Stage 5  |   |             |             |                |
| BIOT3100                                       | Fermentation                                      | 2           | 0           | 5              |
| CEIC3010                                       | Reaction Engineering                              | 0           | 3           | 7.5            |
| CEIC4010                                       | Process Economics 2                               | 1           | 0           | 2.5            |
| INDC3010                                       | I hermodynamics                                   | 3           | 0           | 7.5            |
| INDC3031                                       | Corrosion in the Chemical                         | 0           | 3           | 7.5            |
| 11000041                                       | Industry  | 0           | 3           | 7.5            |
| INDC3050                                       | Chemistry of High<br>Temperature Materials        | 0           | 2           | 5              |
| INDC3060                                       | Unit Operations                                   | 2           | 0           | 5              |
| General Educ                                   | ation subject/s                                   | 4<br>2      | 2           | 10             |
| Total HPW Se<br>Total HPW Se<br>Total Credit I | ession 1 14<br>ession 2 13<br>Points 72.5         |             |             |                |
| Stage 6  | Organia Chamista                                  | ~           | 0           | 15             |
| INDC3070                                       | Instrumentation and Process                       | 3           | 0           | 15             |
| INDC3090                                       | Control 1<br>Chemistry of Industrial              | 0           | 3           | 7.5            |
| POLY3010                                       | Processes<br>Polymer Science                      | 3<br>2      | 3<br>4      | 15<br>15       |
| Total HPW S<br>Total HPW S<br>Total Credit     | ession 1 14<br>ession 2 13<br>Points 52.5         |             |             |                |

# **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 in Process Engineering **8016** or Fuel Technology **8060**.

The School welcomes enquiries from graduates interested in pursuing research for the award of the degrees of:

#### PhD

Chemical Engineering 1010 Industrial Chemistry 1016

#### MSc

Chemical Engineering 2010 Industrial Chemistry 2016

#### ME

Chemical Engineering 2150

### 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 Master of Applied Science degree courses are available in the School of Chemical Engineering and Industrial Chemistry.

#### Process Engineering Course 8016 Fuel Technology Course 8060

Proposed study programs should be submitted 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.

Courses will be run in any year only if sufficient applications are received. A minimum number of 5 registrations is usually required.

### 8016 Process Engineering

#### Master of Applied Science MAppSc

The course will involve full time study at UNSW for overseas students for a period of one year. Australian citizens or permanent residents may elect to take the course in a series of modules over a somewhat longer period. The degree can be obtained by taking a combination of subjects to a minimum number of 120 credit points.

Students with a recognised 4 year BE or BSc degree OR students with a recognised 3 year BE or BSc plus satisfactory industrial experience OR students who submit satisfactory evidence of other academic or professional attainments will be permitted to enrol.

Whilst the program is aimed at maximum flexibility four subjects will be considered as core subjects. These are CEIC5310 Computing Studies in Process Industries, CEIC5311 Instrumental Analysis in Process Industries. CEIC5312 Safety and Communication in the Process Industries, and CEIC5313 Environmental Technologies in Process Industries. These core subjects could be substituted if a student can demonstrate skills in these areas. The core subjects will be offered at periods most convenient to the resource utilisation of the School. 24 credit points can be taken as electives which will be given as one week intensive courses. A 48 credit point project on relevant aspects of process industries, supervised by academic members of staff must be undertaken. Assessment of the project report will be undertaken by at least 2 staff members.

Each student program must be approved by the Head of School or Graduate Studies Coordinator.

The fee for the entire MAppSc program is \$16000. Fees for Australian citizens or permanent residents will be initially set at \$500 per credit point.

#### Core subjects (12 credit points)

| CEIC5310 | Computing Studies in the Process                       |
|----------|--|
| CEIC5311 | Instrumental Analysis in the Process<br>Industries     |
| CEIC5312 | Safety and Communications in the<br>Process Industries |
| CEIC5313 | Environmental Technologies                             |

#### Project (48 credit points)

| CEIC5320 | Process | Engineering | Project |
|----------|---------|-------------|---------|
|----------|---------|-------------|---------|

| Elective subjects (12 credit points) |  |  |  |
|--------------------------------------|--|--|--|
| two to be chosen                     |  |  |  |
| CEIC5330                             | Process Engineering and the Petroleum<br>Industry      |  |  |
| CEIC5331                             | Process Engineering: Natural Gas and Light             |  |  |
| CEIC5332                             | Process Engineering in the Food Industry               |  |  |
| CEIC5335                             | Advanced Computer Methods in the<br>Process Industries |  |  |
| CEIC5336                             | Environmental Chemistry in the Process<br>Industries   |  |  |
| CEIC5337                             | Particle Characterisation in the Process<br>Industries |  |  |
| CEIC5340                             | Polymer Synthesis: Fundamentals and<br>Techniques      |  |  |
| CEIC5341                             | Membrane Technology in the Process<br>Industries       |  |  |
| CEIC5333                             | Experimental Design in the Process<br>Industries       |  |  |

### 8060 Fuel Technology

Master of Applied Science MAppSc

This course is under review and will not be offered in 1997.

# **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.

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

#### APSE0002

Social Issues in Applied Science Staff Contact: School Office CP5 S1 2HPW

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.

#### CEIC0010

#### Mass Transfer and Material Balances Staff Contact: A/Prof M Brungs

CP10 F L1 T1

Prerequisites: CHEM1101, CHEM1201, CIVL2505 Note/s: Servicing subject i.e. a subject taught within courses offered by other faculties.

Mechanisms and models of mass transfer at fixed and free interfaces. Diffusion. Convection. Adsorption. Phase equilibria. Calculation of mass transfer rates at surfaces with simple geometry. Mass transfer in dispersions. Applications of material balances to process calculations in chemical operations. Conventions in methods of analysis and measurement. Stoichiometry. Process calculations associated with gases and liquids. Problems involving bypass, recycle and purge. Differential material balances. Energy balances. Environmental engineering applications.

#### CEIC0020

Fluid/Solid Separation Staff Contact: A/Prof JA Raper CP5 SS L1 T1 Note/s: Servicing subject i.e. a subject taught within

courses offered by other faculties. Particle Characterisation: Size analysis, sphericity, surface

area, density. Fluid-particle Interactions: Drag coefficient, effect of Reynolds number. Terminal velocity, effect of shape, concentration. Drops and bubbles. Particle-particle interactions including flocculation. Flow through porous media. Darcy, Carmen-Kozeny, Ergun equations. Applications of Fluid-Particle Systems: Sedimentation and thickening, elutriation, cyclones, filtration, constant pressure filtration, specific resistance, equipment, filter aids, centrifugal separations.

#### CEIC0030

### **Environmental Protection in the Process Industries**

Staff Contact: Dr P Crisp CP15 S1 L1 T1 S2 L2 T2 Prerequisites: CEIC0010, INDC4120 Note/s: Servicing subject i.e. a subject taught within courses offered by other faculties

The course comprises four components:

#### Process safety

Reliability. Failure rate. Series, parallel and redundant systems. Hazard and operability studies (HAZOP). Risk criteria. Fault treee analysis. Quantitative risk assessment. Pressure and explosion relief. Laboratory safety.

#### Industrial air pollution control

Ventilation. Gas cleaning. Inertial collection. Fabric filtration. Wet scrubbing. Electrostatic precipitation. Removal of pollutant gases. Choice of gas cleaning equipment.

#### Industrial waste treatment

Clean technology. Air pollution. Industrial water pollution control Membrane technology. Waste minimisation. Site remediation. Odour monitoring laboratory. Catalyst technology. Invited lectures. Industry visit. Report writing. Presentation of reports. Case studies.

#### Analysis of pollutants

Laboratory-based component, covering the principal methods used for environmental trace analysis. Gas chromatography. Liquid chromatography. Visible, UV and IR spectrophotometry. Atomic emission and absorption spectrophotometry.

#### CEIC0040

#### Unit Operations in the Process Industries Staff Contact: Dr PT Crisp

CP10 S1 L2 S2 T2

Prerequisites: CHEM1101, CHEM1201, PHYS1989, CEIC0010

**Note/s:** Servicing subject, i.e. a subject taught within courses offered by other faculties.

Heat transfer. Heat exchangers. Condensors, evaporators, boilers. Heating and refrigeration units Gas absorption towers. Distillation. Liquid-liquid extraction processes. Tower equipment. Size reduction. Crushers, grinders, cutters. Filtration. Batch, continuous and clarifying filters. Tank, evaporator and vacuum crystallisers. Dryers and their selection. Particle theory. Sedimentation. Industrial settlers and cyclones. Packed beds. Fluidisation. Sampling of particles. Particle size analysis. Porosity and density measurement. Adsorption. Laboratory visits.

#### CEIC0050

### Atmospheric and Process Chemistry

Staff Contact: Dr PT Crisp CP7.5 S1 L2 T1

Prerequisites: CHEM1101, CHEM1201

Note/s: Servicing subject, i.e. a subject taught within courses offered by other faculties.

Provides essential chemistry for understanding the processes which are responsible for air pollution. Composition and structure of the atmosphere. Natural gas chemistry. Free-radical gas-phase chemistry. Sources,
transformation and sinks for atmospheric gases. Combustion processes. Smog chemistry. Radiochemistry. Biochemistry of toxic chemicals. Chemistry of polluting processes.

### CEIC2010

### Instrumental Analysis

Staff Contact: A/Prof M Brungs

CP15 F L1 T2 Prerequisites: PHYS1002, CHEM1101 and CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241, CHEN1020 or INDC1020

Data treatment, error analysis and propagation of errors. Basic principles of volumetric analysis. Solubility and pH calculations. Electronic analysis potentiometric, voltametric and coulometric. Spectrophotometric - analysis UV/visible, atomic emission, atomic absorbtion, X ray diffraction and fluoresence. Chromatographic analysis, gas chromatography, high performance liquid chromatography, and ion chromatography.

### CEIC2020

Computing

Staff Contact: Dr T Pham CP7.5 S1 L1 S2 L1 T1

Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, CHEM1101 and CHEM1201, 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: A/Prof R Chaplin CP6.5 S1 L1.5 T1 Prerequisites: PHYS1002, CHEM1101 and CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241, CHEN1020 or INDC1020

Distinction between thermodynamic and kinetic control of processes. Definitions of classical thermodynamics. Open and closed systems. Pressure volume temperature properties of industrially important fluids. Applications of thermochemistry in industry. Conversion of heat into work. Concept of lost work. Heat engines and refrigeration cycles. 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 reactor rates. Laboratory kinetic measurements and their relevance to reactor design.

### **CEIC2040**

### Applied Electrochemical and Surface Processes Staff Contact: A/Prof R Chaplin

CP4 S1 L1.5

Prerequisites: PHYS1002, CHEM1101and CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241, CHEN1020 or INDC1020

Electrochemical principles in the context of important industrial electrochemical processes and engineering. Electrolytes, their properties and applications. Industrial electrochemical processes, electrodes and cells. Surface phenomena. Gas-liquid, gas-solid, liquid-solid interfaces. Physical and chemical adsorption. Electrokinetic (zeta) potentials. The colloidal state. Sols, gels and emulsions in industrial processes.

### CEIC3010

Reaction Engineering

Staff Contact: Prof N Foster

*Prerequisites:* CEIC2020, CEIC2030, CEIC2040, CHEN2010 or INDC2010, CHEN2020 or INDC2020, CHEN2030 or INDC2030

Introduction to reactor design: ideal batch, steady state mixed flow, steady state plug flow, size comparisons of ideal reactors, optimisation of operating conditions. Multiple reactor systems: reactors series and parallel, mixed flow reactors of different sizes in series, recycle reactors, autocatalytic reactions. Multiple reactions: reactor design for reaction in parallel and reactions in series, seriesparallel reactions. Temperature effects: heat of reaction, equilibrium constants, optimum temperature progression, adiabatic and non-adiabetic operation, product distribution and temperature. Kinetics of rate processes: Significance of the rate laws and models for distributed and lumped parameter systems. Experimental measurement and correlation of process rates.

## CEIC4010

Process Economics 1 Staff Contact: A/Prof T Tran CP2.5 S1 L1

Consists of the segment Process Economics CHEN3060 Process Plant Engineering 1

### CEIC4020

Process Economics 2 Staff Contact: A/Prof T Tran CP2.5 S2 L1

Project economic evaluation. Discounted cash flow methods. Project financing. Sensitivity analysis and uncertainty. Financial and cost accounting methods.

### **CEIC4070**

Laboratory Automation for Ceramic Engineers Staff Contact: Dr C Dixon CP5 S1 L1 T1 Note/s: Servicing subject i.e. a subject taught within courses offered by other faculties.

Application of microprocessors to laboratory automation. Basics of computing hardware and process interface hardware (A/D D/A conversion, digital 1/0 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.

CEIC4200 Industrial Experience Staff Contact: Dr C Dixon CP40

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 CP0

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.

## CEIC5000

### Major Project

Staff Contact: A/Prof G Sergeant (Dept of Fuel Technology) Staff Contact: A/Prof R Burford (Dept of Polymer Science) CP30

A substantial project on some aspects of chemical engineering, industrial chemistry, polymer science, fuel technology or biological process engineering.

### CEIC5010

### **Minor Project**

Staff Contact: A/Prof G Sergeant (Dept of Fuel Technology) Staff Contact: A/Prof R Burford (Dept of Polymer Science) CP15

A minor investigation on some aspect of chemical engineering, industrial chemistry, polymer science, fuel technology or biological process engineering.

### CEIC5310

# Computing Studies in the Process Industries Staff Contact: Dr T Pham

CP12

Introduction to computing systems. Hardware, personal computers, software. Operating systems: DOS, Windows. Languages: Basic, Pascal. Introduction to computing applications: Word Processing, Spreadsheets, Data bases, Equation Solvers with specific reference to solution of Process Engineering problems.

### CEIC5311

### Instrumental Analysis in the Process Industries Staff Contact: A/Prof M Brungs

CP12

The course will encompass both chemical and physical analysis of materials. The basic principles of laboratory and on-line instrumentation will be examined and this material will be reinforced by appropriate laboratory classes. Selected topics include: analyses of and for water, colour, density and viscosity, spectroscopic, electrochemical and chromatographic techniques. The course will also include aspects of sampling and Laboratory Information Management Systems (LIMS).

### CEIC5312

# Safety and Communications in the Process Industries

Staff Contact: Prof D Trimm CP12

Toxicity of chemicals. Material safety data sheets. Storage of hazardous materials. Disposal of hazardous materials. Air pollution and ventilation, electrical and mechanical aspects of machinery. General laboratory safety. Fire precautions in laboratories. Fire fighting training. The principles of hazard analysis and hazardous operations. Safety with large scale equipment. Plant visits. Oral and written communication. The basis of writing proposals and reports. Error analysis. Verbal presentations to small and larger audiences. Use of slides and overheads.

### CEIC5313

Environmental Technologies Staff Contact: Prof A Fane CP12

This subject deals with conventional and advanced separation processes for pollution control, effluent treatment and waste minimisation in the Process Industries. Topic areas covered will be selected from:

Gravity Separations, Filtration Processes, Sorption Processes, Extraction Processes, Membrane Technology, Biological Processes, Design, Control and Monitoring, Clean Production Technologies.

### CEIC5320

Process Engineering Project Staff Contact: A/Prof R Chaplin CP48

An investigation of a problem in any area related to process engineering which involves a significant research or design component. Such an investigation should be related to the research interests and expertise of staff in the School of Chemical Engineering and Industrial Chemistry. If the student chooses a research project, a course on research methods must also be taken.

### CEIC5330

#### Process Engineering in the Petroleum Industry Staff Contact: Dr A Adesina CP12

1) Origin and nature of crude oil overview of the Petroleum refinery. 2) Petroleum processing operations Hydrotreating, desulphurisation, denitrogenation, demetallation, deoxygenation, hydrocracking. Process description flow sheet, hydrogen supply, operating conditions, reactor types. 3) Catalytic cracking: Feed classification, supply and associated reactions. Mechanism of catalytic cracking. Cracking catalysts bifunctionality, properties, testing, coking and longevity. Process Engineering operating variables, reactor types and arrangement, design of fluid catalytic crackers. 4) Catalytic Reforming: Thermodynamics of catalytic reforming Individual reactions. The balance between catalyst efficiency and catalyst life. Catalysts. Deactivation. Reactor design. Residue Processing. Production of fuels, residues and carbon.

### CEIC5331

### Process Engineering: Natural Gas and Light Hydrocarbons to Petrochemicals Staff Contact: Dr A Adesina

CP12

Feedstock for the petrochemical industry. Natural gas, synthesis gas, LPG, C4 hydrocarbons. Syngas production. Steam reforming, carbon dioxide reforming, water gas shift, partial oxidation. Process based on C1 chemistry catalysts, processes and reactors. Methanation and Fischer-Tropsch synthesis, methanol synthesis. Olefin production (ethylene, propylene and butene). Steam cracking, catalytic cracking, thermal dehydrogenation, catalytic (oxidative) dehydrogenation. Manufacture of base petrochemicals. Synthesis of ethylene oxide, aldehydes and acetic acid production, hydroformylation, hydration and halogenation compounds. Manufacture of vinyl monomers and condensation polymer feedstocks.

### CEIC5332

### Process Engineering in the Food Industry Staff Contact: Dr T Pham CP12

This course covers the application of process engineering techniques in the food industry, with its particular emphasis on product sensory quality and hygiene. The topics

on product sensory quality and hygiene. The topics considered will include evaporation and drying, separation, refrigeration, thermal processing, prediction of quality and microbiological changes, and computer techniques. The course will include lectures, assignments and one major design project.

### CEIC5333

### Experimental Design in the Process Industries Staff Contact: A/Prof R Chaplin

CP12

This course is structured to provide a sound introduction to the fundamentals of experimental design and its impact on productivity and quality in research development and manufacturing processes. Topics covered will include: basic statistical hypothesis testing, quality control, control charts, regression analysis, factional designs, fractional factional designs, screeing designs, linear and curve-linear models, non-linear models, Taquchi concepts, optimisation, response surface concepts.

### CEIC5335

# Advanced Computer Methods in the Process Industries

Staff Contact: A/Prof R Chaplin CP12

Solution of Process Engineering problems, troubleshooting and Process Design utilising advanced computer applications including flowsheeting, numerical methods, statistical design, CAD and process integration.

### **CEIC5336**

### Environmental Chemistry in the Process Industries Staff Contact: Dr P Crisp

CP12

Introduction to the chemical processes underlying major problems. The following topics will be covered: soil chemistry, acid rain, land degradation, urban air pollution, ozone depletion, global climatic change, radioactive contamination, alternative energy sources, chemical waste contamination, toxic elements, toxic organics, absorption processes and occupational diseases. The role of the chemical industry in causing and resolving the problems will be examined.

### CEIC5337

### Particle Characterisation in the Process Industries Staff Contact: A/Prof J Raper

CP12

This course will cover theoretical principles and practical aspects of methods of characterising fine particulate materials. Characteristics investigated include: particle size and size distribution, density, porosity, surface area, zeta potential and electrostatic charge, morphology and structure. Techniques covered include: sedimentation, optical techniques, electrozone sensing, image analysis, time of flight analysis, inertial impaction, mercury porosimetry, gas adsorption, helium pycnometry, morphological analysis. Practical examples of industrial applications will be given together with laboratory demonstrations using all the techniques.

### **CEIC5340**

### Polymer Synthesis: Fundamentals and Techniques Staff Contact: A/Prof R Chaplin

CP12

Polymerisation fundamentals: radical chain polymerization, ionic chain polymerization, Ziegler-Natta polymerization of olefins, step growth polymerization, production of polyesters, polyamides, polycarbonates and polyurethanes. Polymerisation Processes: bulk emulsion, solution and suspension polymerization of vinyl monomers, specialised techniques for ionic and coordination polymerisations, condensation polymerization.

### CEIC5341

### Membrane Technology in the Process Industries Staff Contact: Prof A Fane

CP12

Classification of membranes and membranes processes. Driving forces and mass transfer mechanisms. Characterisation for membranes. Control of concentration polarisation and fouling. Aspects of the design of membranes, membrane modules and membrane systems. Operating principles of major membrane processes include microfiltration, ultrafiltration, nanofiltration, reverse osmosis, dialysis, electrodialysis, membrane distillation, pervaporation, gas permeation, liquid membranes. Selected applications and economic aspects of membrane technology in the fields of biotechnology, biosensors (including bioreactors), controlled release, chemical and food processing, water and waste treatment.

### **CEIC5342**

### Energy Management in the Process Industries Staff Contact: A/Prof G Sergeant

CP12

Examination of all aspects of the energy management process engineering plants and the impact on environmental emissions. Topics to be covered include: combustion of solid, liquid and gaseous fuels, energy balances around, furnaces, energy audits, heat return and heat recovery in process plants.

### CEIC5630

#### Industrial Water and Wastewater Engineering Staff Contact: Prof AG Fane CP12 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.

# CEIC5890

Graduate Colloquia Staff Contact: School Office CP24

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 CP24

### CEIC5930

Safety in Laboratories Staff Contact: A/Prof R Chaplin CP4 S1

Storage of hazardous materials. Disposal of hazardous materials. Air pollution and ventilation. Electrical and mechanical aspects of machinery. General laboratory safety. Microbiological safety precautions. Toxicology. Carcinogens and safety. Ionising and non-ionising apparatus. Protective clothing. Precautions against hearing loss. Chemistry and physics of flames. Fire precautions in the laboratories. Fire fighting training.

### CHEN1010

Introduction to Chemical Engineering Staff Contact: Dr D Wiley CP10 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 stoichoimetry. Introduction to material balancing. Process calculations associated with gases, vapours and liquids.

## CHEN1020

Engineering 1 CE Staff Contact: Dr C Dixon CP30 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: A/Prof M Brungs CP10 F L1 T1

Prerequisites: CHEM1020, CHEN1020, MATH1032 or MATH1231 or MATH1042 or MATH1241, PHYS1002

Material Balances: Revision of material balances. Problems involving bypass, recycle and purge. Problems involving staged operations. Differential material balances. Energy Balances: Thermodynamic background. First law; phase rule; reference states. General equation and its integral/differential form. Open and closed systems. Shaft work and enthalpy. Application of energy balances to constant composition systems; enthalpy data; heat capacity data; phase change. Application to varying composition systems: Mixing; Heat of solution; Enthalpy concentration diagrams. Reactions. Heats of formation and combustion. Integrated Material and Energy balance problems. Students not taking CHEN1010 will be required to complete a 28-hour bridging course offered by the School early in Session 1.

### CHEN2020

Flow of Fluids Staff Contact: Dr R Amal CP10 F L1 T1 Prerequisites: PHYS1002, CHEN1020, CHEM1101 and

CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241

Units and dimensions. Fundamental concepts of Fluids. Simplification of the Navier-Stokes Equation: Fluid statics, continuity, Bernoulli's equation, momentum and energy equations. Flow in closed conduits, including laminar and turbulent flow and losses due to friction. Flow in open channels; hydraulic jump. Pumps and pumping; blowers and compressors, pipes and fittings. Measurement in Fluid Mechanics; viscosity, pressure, velocity, flowrate. Compressible flow.

### CHEN2030

### **Heat Transfer**

Staff Contact: Dr R Sheikholeslami CP7.5 S2 L2 T1

Prerequisites: PHYS1002, CHEN1020, CHEM1101 and CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241

Conduction: Steady state, one dimensional heat flow. Resistance concept, series and parallel. Unsteady state conduction. Convection: Laminar and turbulent flow. Analogies between Momentum and Heat Transfer. Correlations for flow in and across tubes and other surfaces. Free convection. Radiation: Black and grey bodies. Shape factors, reciprocity. Radiation from gases. Heat Transfer with phase change: Nucleate and film boiling. Condensation and effect of presence of inerts. Applications: Introduction to Heat Exchangers. Log mean temperature difference. Effectiveness NTU relationships. Extended surfaces.

### **CHEN2040**

Mass Transfer Fundamentals Staff Contact: Dr A Adesina CP5 S2 L1 T1 Prerequisites: PHYS1002, CHEM1101 and CHEM1201, CHEN1020, MATH1032 or MATH1231 or MATH1042 or MATH1241

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: Prof N Foster CP12.5 S1 T3 S2 T2 Prerequisites: PHYS1002, CHEM1101 and CHEM1201, CHEN1020, MATH1032 or MATH1231 or MATH1042 or MATH1241

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 CP10 S1 HPW4 Prerequisites: CEIC2030, CEIC2040, CHEN2010, CHEN2020

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. Engineering applications of thermodynamics. Heat engines, refrigeration.

### CHEN3020

Quantification of Chemical Processes Staff Contact: Dr DC Dixon

CP7.5 S1 L1 S2 L1 T1 Prerequisites: CEIC2020, MATH2021, MATH2819

Basic concepts in process quantification. Solutions to chemical engineering applications by use of single and multiple, linear and non-linear, non-differential equations. Optimisation of chemical processes. Single and multiple dimensional search, linear programming, dynamic programming applications to process industry problems.

# CHEN3030

Fluids 2 Staff Contact: Dr T Pham CP5 S1 HPW2 Prerequisites: CEIC2020, CHEN2020, MATH2021

Single and Two-phase flow. Derivation of Navier-Stokes Equation and solutions for inviscid flow, boundary layer flow, non-Newtonian flow.

# CHEN3040

Separation Processes 1 Staff Contact: Prof N Foster CP10 F L1 T1

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

Stagewise Processes: Phase equilibrium. Absorption. Binary distillation. Liquid-liquid extraction. Design of Mass Transfer Equipment: Equipment design for absorption, distillation, liquid liquid extraction and adsorption processes. Unit design for stagewise and differential contact. Design of equipment for membrane and other surface separation processes. Simultaneous Heat and Mass Transfer: Psychrometry. Cooling Towers. Drying.

## CHEN3050

Particle Mechanics Staff Contact: A/Prof J Raper CP7.5 S2 L2 T1 Prerequisites: CE1C2020, CHEN2020, MATH2021, MATH2819

Particle characterisation: Size analysis, sphericity, surface area, density. Fluid particle interactions: drag coefficient, effect of Reynolds number. Terminal velocity, effect of shape, concentration. Drops and bubbles. Particle particle interactions including flocculation. Flow through porous media. Darcy, Carman-Kozeny, Ergun equations. Applications of fluid-particle systems: Sedimentation and thickening. Elutriation. Cyclones. Packed beds. Single phase flow. Two phase flow in trickle beds. Filtration: constant pressure theory, specific resistance, equipment, filter aids, centrifugal. Fluidisation: minimum fluidisation velocity, two phase theory, bubble properties, applications. Spouting, Pneumatic and hydraulic conveying, Solids 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 CP20 F L3 T1 Prerequisites: CHEN2010, CHEN2020, CHEN2030, 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 off-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.

### CHEN3061

## Process Plant Engineering 1(Petroleum Engineering)

Staff Contact: Mr A Papagelis CP17.5 S1 L3 S2 L3 T1 Prerequisites: CHEN2010, CHEN2020, CHEN2030, MATH2021

Subject description as for CHEN3060

### CHEN3070

Process Control Staff Contact: Dr C Dixon CP5 S2 L2 Prerequisites: CEIC2010, CEIC2020, MATH2021

Unsteady state modelling of simple processes: linearisation, transfer function, concept of input-output models. Lumped parameter versus distributed parameter systems. Process identification: transient, frequency, pulse and correlation analysis. Control system hardware: transducers, valves, measuring devices for flow, pressure, temperature.

# CHEN3080

### Chemical Engineering Laboratory 2

Staff Contact: Prof N Foster

CP7.5 F T1.5

*Prerequisites:* CHEM2828, CHEM2011, CEIC2010, CEIC2020, CHEN2010, CHEN2020, CHEN2030, CHEN2040, 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: A/Prof Tam Tran CP20 F L2 T2 Prerequisites: CHEM2011, CEIC2020, CHEN2010, CHEN2020, CHEN2030, MATH2021, MATH2819

Application of chemical engineering principles to biochemical engineering, fuel engineering, and minerals processing. Integrated problems illustrating skills in process analysis.

### CHEN4010

**Separation Processes 2** 

Staff Contact: Dr T Pham

CP5 S1 L1 T1 Prerequisite: CHEN3010, CHEN3020, CHEN3040, MATH3021

Separation of multi-component systems by stagewise operations. Multi-component separations using modern computer techniques. Phase equilibrium relationships for liquid-vapour and liquid-liquid systems. Azeotropic and extractive distillation.

### CHEN4020

# Advanced Reaction Engineering

Staff Contact: Dr A Adesina CP5 S1 L1 T1 Prerequisites: CEIC3010, CHEN3020, CHEN3030, CHEN3040, MATH3021

Heterogeneous Systems: Kinetics of uncatalysed gas-solid and liquid-solid reactions. Kinetic models for catalytic reactions. Inter and intraparticle diffusional effects in fluid-solid systems. Design of fixed bed catalytic reactors in adiabatic and non-adiabatic and non-isothermal operation. Trickle bed reactors. Slurry reactors for batch and continuous operation. Laboratory reactors for determining kinetic parameters in heterogeneous systems.

# CHEN4030

**Environmental Pollution Control** 

Staff Contact: Prof A Fane

CP5 S1 L2

Prerequisites: CHEN3030, CHEN3040, CHEN3050, CHEN306

Water pollution design and operation strategies; treatment operations; economic aspects. Air pollution- effluent dispersions: types of gas cleaning units, choice of gas cleaning equipment. Noise pollution and pollution control legislation.

### CHEN4070

### **Process Dynamics and Control**

Staff Contact: Dr C Dixon CP12.5 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 multi-variable control.

### CHEN4081

Design Project Staff Contact: Dr D Wiley CP15 S1 T3 S2 T3 Prerequisite: All Year 3 subjects

Safety: Techniques for assessing safety of existing and proposed plants. Systems reliability, HAZOP and HAZAN. Pressure and explosion relief. Laboratory Safety.

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 CP30 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 CP15 F L2 T1 Prerequisite: All Year 3 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.

### **CHEN4110**

### **Process Analysis and Synthesis**

Staff Contact: Mr AJ Papagelis CP7.5 F L.5 T1 Prerequisite: CHEN3060, CHEN3070

Process diagnostics. Trouble shooting. Heat exchanger networks. Optimum energy utilisation methods.

### **CHEN4120**

# **Process Plant Management and Operation**

Staff Contact: A/Prof JA Raper CP15 F L1 T2 Prerequisite: All Year 3 subjects.

The management and practical operation of computer controlled chemical plant. Experience is gained in business practices including: company types, structure and organisation, company financing and operation, personnel management, accounting, company law, industrial relations and trade union practices, marketing. A Business Plan is written and company liquidation is undertaken. Product development and quality management issues are covered.

### **CHEN4121**

### Process Plant Management and Safety

Staff Contact: Prof AG Fane CP12.5 S1 L2.5 T2.5 Prerequisite: CHEN3030, CHEN3040, CHEN3050, CHEN3060

This subject is provided for those students taking the Fuel and Energy Engineering and Minerals Engineering electives. Comprises the Management component of CHEN4120 and the Safety component of CHEN4030.

### FUEL0040

#### **Fuel Engineering for Ceramic Engineers** Staff Contact: Dr JF Stubington CP5 F L1 or S1 L2

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: Dr JF Stubington CP7.5 S1 L2 S2 L1

An introduction to combustion technology, fuel plant technology and fuel processing.

### **FUEL4010**

**Fuel and Energy Engineering 2** Staff Contact: Dr JF Stubington CP32.5 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: Dr JF Stubington CP30 S1 T2 S2 T10

Investigation of some aspect of fuel engineering.

### **FUEL5800**

### **Fuel Seminar**

Staff Contact: Dr JF Stubington CP4

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

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: Dr JF Stubington **CP16** 

Note/s: One Session Unit (SU) is equal to 1 hour per week for session of 14 weeks. Select from following units:

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: Dr JF Stubington **CP16** 

Note/s: One Session Unit (SU) is equal to 1 hour per week for session of 14 weeks. Select from following units:

Unit 1 2 (SU) Carbonisation and gasification processes.

Unit 2 1 (SU) Liquid fuels from coals.

Unit 3 1 (SU) Chemicals from coals.

### **FUEL5840**

### **Fuel Plant Engineering**

Staff Contact: Dr JF Stubington CP24

Note/s: One Session Unit (SU) is equal to 1 hour per week for session of 14 weeks. Select from following units:

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: Dr JF Stubington CP16

**Note/s:** One Session Unit (SU) is equal to 1 hour per week for session of 14 weeks. Select from following units:

unit 1 1 (su) combustion technology.

- unit 2 1 (su) fuel impurities, removal of and deposits from.
- unit 3 1 (su) efficiency in energy utilisation.

unit 4 1 (su) combined cycles and integrated systems.

### **FUEL5870**

### **Fuel Technology Practice**

Staff Contact: Dr JF Stubington CP16

**Note/s:** One Session Unit (SU) is equal to 1 hour per week for session of 14 weeks.

Compulsory in MAppSc (Fuel) (4 SU).

### FUEL5880

# Unit Operations in Wastewater, Sludge and Solid Waste Management

Staff Contact: Dr JF Stubington CP12

Physical wastewater treatment processes including sedimentation, flotation, flocculation, precipitation. Sludge management including conditioning, filtering, lagoons, drying. Introductory fuel engineering. Combustion principles. Incineration. Pyrolysis. Gasification. Resource recovery and recycling. Incinerator and afterburner design. Wastewater and sludge components given in Civil Engineering.

### **FUEL5881**

# Unit Operations in Wastewater, Sludge and Solid Waste Management

Staff Contact: Dr JF Stubington CP12

Syllabus as for FUEL5880. FUEL5881 is for external students in waste management courses.

### FUEL5910

### Atmospheric Pollution and Control (Theory)

Staff Contact: Dr JF Stubington CP12 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: Dr JF Stubington CP12 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.

### INDC1010

# Industrial Chemistry 1

Staff Contact: Dr D Wiley CP10 F L1 T1 Prerequisites: PHYS1002, MATH1032 or MATH1231 or MATH1042 or MATH1241

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.

Application of process calculations in chemical process operations. Conventions in methods of analysis and measurement. The chemical equation and stoichiometry. Introduction to materials balancing. Process calculations associated with gases, vapours and liquids.

### INDC1020

Engineering 1 IC Staff Contact: Dr C Dixon CP30 S1 L2 T4 S2 L3 T3

This subject is comprised of INDC1010 Industrial Chemistry 1, 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

CP5 S1 L1 T1 Prerequisites: CHEM1101 and CHEM1201, INDC1020, MATH1032 or MATH1231 or MATH1042 or MATH1241, PHYS1002

Material Balances: Revision of material balances. Problems involving bypass, recycle and purge. Problems involving staged operations. Differential material balances. Energy Balances: Thermodynamic background. First law; phase rule; reference states. General equation and its integral differential form. Open and closed systems. Application of energy balances to constant composition systems; enthalpy data; heat capacity data; phase change. 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: Dr R Amal CP7.5 S1 T2 S2 L1 Prerequisites: PHYS1002, MATH1032 or MATH1231 or MATH1042 or MATH1241, CHEM1101 and CHEM1201, 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 R Chhabra

CP5 S2 L1 T1

Prerequisites: PHYS1002, MATH1032 or MATH1231 or MATH1042 or MATH1241, CHEM1101 and CHEM1201, 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 CP5 S1 T2

Prerequisites: PHYS1002 (or CHEM1101 and CHEM1201), CHEM1102, CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241, 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 CP7.5 S1 L2 T1 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 homegeneous mixtures. Chemical reaction equilibria; calculation of equilibrium compositions for single reactions. Phase equilibria; the phase rule, equilibrium.

### INDC3031

Experimental Design Staff Contact: A/Prof R Chaplin CP7.5 S1 L2 S2 T1 Prerequisite: MATH2819

Regression analysis. Statistical design of experiments. Two level factorial designs. Screening experiments. Optimisation of process variables. Spread sheet and database utilisation. Basic programming. Industrial applications.

### INDC3041

Corrosion in the Chemical Industry Staff Contact: Prof M Skyllas-Kazacos CP7.5 S2 L2 T1 Prerequisite: CEIC2030, CEIC2040

Selection of materials for chemical plant. Strength and corrosion resistance of less common materials of fabrication. Chemical and electrical aspects of corrosion and their application to corrosion problems encountered in the chemical process industries. Electrochemical kinetics. Design factors for corrosion prevention. Methods of corrosion prevention.

### INDC3050

Chemistry of High Temperature Materials Staff Contact: A/Prof M Brungs CP5 S2 L2 Prerequisite: CEIC2030,CEIC2040

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 CP5 S1 L2 Prerequisites: INDC2010, CEIC2030, CEIC2040

This course will emphasise the qualitative aspects of major unit operations in the chemical process industries. Topics covered include gas absorption, liquid-liquid extraction, distillation, filtration, evaporation, centrifugation, drying and leaching operations, particle size reduction and enlargement.

### INDC3070

Instrumentation and Process Control 1 Staff Contact: Dr C Dixon CP7.5 S2 L2 T1 Prerequisites: MATH2021, CEIC2010, CEIC2020

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 CP10 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 CP15 F L1 T2 Prerequisite: CEIC 2030, CEIC 2040 Corequisites 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 enthylene 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.

### INDC4040

Management Staff Contact: Dr T Davis CP5 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.

### INDC4060

Process Design Staff Contact: A/Prof MP Brungs CP17.5 S1 L2 T1 S2 L1 T3 Prerequisite: INDC3010, INDC3060, CEICP12010

This course will encompass the complete process design of a given (small) chemical plant. Students will be required to produce a design report which will include an environmental impact statement, plant sizing, process flow sheet, equipment selection and costing and a financial evaluation of the whole process. The report will also discuss the relevant thermodynamic and kinetic aspects of the process.

### INDC4070

Laboratory Automation Science Staff Contact: Dr DC Dixon CP10 S1 L1.5T2.5 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. Organisation 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 CP10 F T2

Students are required to deliver two lectures 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 CP60 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.

### INDC4120

Chemistry of the Industrial Environment Staff Contact: Dr PT Crisp CP7.5 S1 L2 T1 Prerequisites: CHEM1101, CHEM1201

Soil chemistry. Occupational diseases. Smogs and acid rain. Toxic elements and compounds. Toxic waste disposal. Industrial accidents. Atmospheric structure and chemistry. Greenhouse warming. The Ozone hole. Nuclear energy. Alternative energy sources. Water analysis. Air analysis. Occupational health.

### INDC4130

Environmental Chemistry of Industrial Processes Staff Contact: Dr PT Crisp CP5 S1 L2 Prerequisites: CHEM1101, CHEM1201

Soil chemistry. Occupational diseases. Smogs and acid rain. Toxic elements and compounds. Toxic waste disposal. Industrial accidents. Atmospheric structure and chemistry. Greenhouse warming. The Ozone hole. Nuclear energy. Alternative energy sources. Water analysis. Air analysis. Occupational health.

### MINP4010

#### Hydrometallurgical Processes Staff Contact: A/Prof T Tran

CP5 S1 L2

Application of principles of aqueous thermodynamics, electrochemistry, chemical 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: A/Prof T Tran CP7.5 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 mineral engineering to develop investigational skills for process development.

### **MINP4030**

Hydrometallurgical Process Engineering Staff Contact: Dr T Tran CP5 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.

# POLY0010

**Polymer Materials** 

Staff Contact: A/Prof R Burford CP15 S1 2 S2 4

Note/s: servicing subject i.e. a subject taught within courses offered by other faculties

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.

### POLY3010

**Polymer Science** Staff Contact: A/Prof R Burford CP15 S1 L2 S2 Lab.4 Prerequisites: CHEM2011, CHEM2021, MATH2021, **MATH2819** Co or Prereauisites: INDC3090

Polymerization chemistry and processes. Step and radical chain polymerization. Ionic (including stereoregular) polymerization. Methods including bulk, suspension, emulsion, solution and gas phase polymerisation. Industrially important polymers and their manufacture. Principles of analysis. Molecular weight distribution. Thermodynamics of polymer solutions. Polymer chain conformation. Viscoelasticity. Mechanical behaviour. Polymer morphology. Thermal behaviour and analysis. Chemistry and physics of elastomers. Elements of polymer compounding and fabrication. New polymers.

### POLY4010

Advanced Polymer Science Staff Contact: A/Prof R Burford CP5 S1 L2

Prerequisite: POLY3010

Selected topics from basic texts and the original literature covering polymer chemistry: anionic cationic and Ziegler-Natta catalysis in polymer chemistry. Particular emphasis is placed on stereoregular polymerization for polyolefin manufacture, stressing mechanisms and reactor configuration. The mechanism and use of metallacene based catalysts. Free radical polymerization mechanism of homo- and copolymerization.

### **POLY5000**

**Polymer Science** Staff Contact: A/Prof R Burford CP30 F L3 T3

Polymer Processes: Classification of polymers, methods of polymerisation; 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 polymerisation, kinetics, structure effects; chain growth polymerisation. Free radical polymerisation, chemistry and properties of free radicals and initiators; kinetics of propagation and termination reactions; co-polymerisation; monomer radical structure and reactivity. Cationic and anionic polymerisation; stereoregular polymers. Polymer Characterisation: 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.

76 APPLIED SCIENCE

# School of Fibre Science and Technology

Head of School Professor RE Griffith

#### Administrative Officer Ms F Colville

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), Textile Management, and Textile Design and Technology.

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.

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 \$10,400 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.

# Department of Textile Technology

# Head of Department

## Professor MT Pailthorpe

Textile Technology is concerned with the conversion of both natural and man-made fibres into an extremely wide variety of finished products. These products range from fabrics for apparel, soft furnishings, floor coverings and industrial use to such specialised textiles as tyre cord, ropes, protective clothing, sailcloth, parachute fabrics, medical dressings, composite materials, and many others.

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, Management and Design.

The Department of Textile Technology offers courses in Textile Technology **3170** and Textile Management **3175**. In 1997 it is expected that a new course Textile Design and Technology **3177** will be available, subject to UNSW Council approval. These 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 qualify for membership of the Textile Institute.

Students 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 Year 3.

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), 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 or man-made fibres, yarns, fabrics, etc; dyeing, printing and finishing of textiles, quality assurance, marketing and retailing.

# **Undergraduate Study**

# **Course Outlines**

# 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, include a study in depth of one of the following: chemistry, engineering or physics.

Graduates will qualify for membership for one of the following professional bodies: the Royal Australian Chemical Institute; the Institution 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.

|                    |                             | HI<br>S1 | S2 | СР |
|--------------------|-----------------------------|----------|----|----|
| Year 1 All Op      | otions                      |          |    |    |
| CHEM1101           | Chemistry 1A, and           | 6        | 0  | 15 |
| CHEM1201           | Chemistry 1B                | 0        | 6  | 15 |
| FIBR1101           | Fibre Science 1             | 4        | 0  | 10 |
| MATH1131           | Mathematics 1A or           |          |    |    |
| MATH1141           | Higher Mathematics 1A       | 6        | 0  | 15 |
| MATH1231           | Mathematics 1B or           |          |    |    |
| MATH1241           | Higher Mathematics 1B       | 0        | 6  | 15 |
| PHYS1002           | Physics 1 or                |          |    |    |
| PHYS1022           | Physics for Health and Life |          |    |    |
|                    | Scientists*                 | 6        | 6  | 30 |
| TEXT1201           | Introductory Textile        |          |    |    |
|                    | Technology                  | 0        | 4  | 10 |
| Total HPW S        | ession 1 22                 |          |    |    |
| <b>Total HPW S</b> | ession 2 22                 |          |    |    |
| Total Credit       | Points 110                  |          |    |    |

\*For admission into the Textile Physics or Textile Engineering options, students must complete the subject: PHYS1002.

# Textile Chemistry

|  |                                | HF<br>S1 | PW<br>S2 | СР   |  |
|--|--------------------------------|----------|----------|------|--|
| Year 2   |                                |          |          |      |  |
| CEIC2010   | Instrumental Analysis          | 3        | 3        | 15   |  |
| CHEM2021   | Organic Chemistry              | 0        | 6        | 15   |  |
| CHEM2819   | Physical Chemistry for Food    |          |          |      |  |
|  | and Fibre Science              | 6        | 0        | 15   |  |
| FIBR2201   | Computing Applications         | 4        | 0        | 10   |  |
| TEXT2101   | Fibre Science 2                | 0        | 4        | 10   |  |
| TEXT2201   | Textile Statistics             | 0        | 2        | 5    |  |
| TEXT2301   | Yarn Technology 1              | 6        | 0        | 15   |  |
| TEXT2401   | Fabric Technology 1            | 0        | 6        | 15   |  |
| General Educa  | ation subject/s                | 2        | 2        | 15   |  |
| Total HPW Session 121Total HPW Session 223Total Credit Points115 |                                |          |          |      |  |
| Year 3   |                                |          |          |      |  |
| CHEM3021   | Organic Chemistry              | 6        | 0        | 15   |  |
| Plus one of the  | e following Chemistry elective | s        |          |      |  |
| CHEM2031   | Inorganic Chemistry and        |          |          |      |  |
|  | Structure or                   | 0        | 6        | 15   |  |
| CHEM3121   | Synthetic Organic              |          |          |      |  |
|  | Chemistry or                   | 0        | 6        | 15   |  |
| CHEM3321   | Applied Organic Chemistry      | 6        | 0        | 15   |  |
| or an alternati  | ve as approved by the Head of  | of De    | eparti   | ment |  |
| TEXT3602   | Colouration Technology         | 0        | 4        | 10   |  |
| TEXT3301   | Yarn Technology 2              | 0        | 6        | 15   |  |
| TEXT3401   | Fabric Technology 2            | 6        | 0        | 15   |  |
| TEXT3501   | Finishing Lechnology A         | 4        | 0        | 10   |  |
| TEXT3601   | Colour Science                 | 3        | 0        | 7.5  |  |
| 1EX13101   |                                | 3        | 0        | 7.5  |  |
| TEX13801   | l extile Engineering           | 0        | 3        | 1.0  |  |
| General Educ   | ation subject/s                | 2        | 2        | 13   |  |
| Total HPW Se   | ession 1 24                    |          |          |      |  |
| Total HPW Se   | ession 2 21                    |          |          |      |  |
| Total Credit F   | Points 117.5                   |          |          |      |  |

# **Textile Physics**

| Year 2              |                          |   |     |     |
|---------------------|--------------------------|---|-----|-----|
| FIBR2201            | Computing Applications   | 4 | 0   | 10  |
| MATH2100            | Vector Calculus          | 0 | 2.5 | 7.5 |
| MATH2120            | Mathematical Methods for |   |     |     |
|                     | Differential Equations   | 0 | 2.5 | 7.5 |
| PHYS2001            | Mechanics and            |   |     |     |
|                     | Computational Physics    | 4 | 0   | 15  |
| PHYS2011            | Electromagnetism and     |   |     |     |
|                     | Thermal Physics          | 0 | 4   | 15  |
| PHYS2021            | Quantum Physics and      |   |     |     |
|                     | Relativity*              | 2 | 2   | 15  |
| TEXT2101            | Fibre Science 2          | 0 | 4   | 10  |
| TEXT2201            | Textile Statistics       | 0 | 2   | 5   |
| TEXT2301            | Yarn Technology 1        | 6 | 0   | 15  |
| TEXT2401            | Fabric Technology 1      | 0 | 6   | 15  |
| General Educ        | ation subject/s          | 2 | 2   | 15  |
| Total HPW Se        | ession 1 20.5            |   |     |     |
| Total HPW Se        | ession 2 22.5            |   |     |     |
| <b>Total Credit</b> | Points 130               |   |     |     |

\*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.

|                                   |   | HF<br>S1 | W<br>S2 | СР    |  |
|-----------------------------------|---|----------|---------|-------|--|
| Year 3                            |   | -        |         |       |  |
| PHYS2031                          | Laboratory*   | 3        | 3       | 15    |  |
| Plus Physics e<br>session, select | lectives averaging not less the<br>ed from the following: | en 3     | hour    | s per |  |
| PHYS3021                          | Statistical Mechanics and                                 |          |         |       |  |
|                                   | Solid State Physics                                       | 4        | 0       | 15    |  |
| PHYS3060                          | Advanced Optics   | 0        | 2       | 7.5   |  |
| PHYS3110                          | Experimental Physics B1                                   | 4        | 0       | 7.5   |  |
| PHYS3120                          | Experimental Physics B2                                   | 0        | 4       | 7.5   |  |
| PHYS3410                          | Biophysics  | 0        | 2       | 7.5   |  |
| PHYS3710                          | Advanced Laser and Optical<br>Applications (offered odd   |          |         |       |  |
|                                   | numbered years only)                                      | 2        | 0       | 7.5   |  |
| or an alternativ                  | ve as approved by the Head o                              | of De    | eparti  | ment  |  |
| TEXT3101                          | Textile Structures 1                                      | 3        | 0       | 7.5   |  |
| TEXT3301                          | Yarn Technology 2   | 0        | 6       | 15    |  |
| TEXT3401                          | Fabric Technology 2                                       | 6        | 0       | 15    |  |
| TEXT3501                          | Finishing Technology A                                    | 4        | 0       | 10    |  |
| TEXT3601                          | Colour Science  | з        | 0       | 7.5   |  |
| TEXT3602                          | Colouration Technology                                    | 0        | 4       | 10    |  |
| TEXT3801                          | Textile Engineering                                       | 0        | 3       | 7.5   |  |
| General                           |   |          |         |       |  |
| Education sub                     | oject/s   | 2        | 2       | 15    |  |
| Total HPW Session 1 24            |   |          |         |       |  |
| Total HPW Se                      | ession 2 21   |          |         |       |  |
| Total Credit F                    | Points 117.5  |          |         |       |  |

\*See note for Year 2

# **Textile Engineering**

| Year 2                 |                           |   |   |     |
|------------------------|---------------------------|---|---|-----|
| CIVL0616               | Structures                | 3 | 0 | 7.5 |
| ELEC0807               | Electrical Engineering 1E | 0 | 3 | 7.5 |
| FIBR2201               | Computing Applications    | 4 | 0 | 10  |
| MATH2021               | Mathematics               | 2 | 2 | 15  |
| MECH1110               | Graphical Analysis and    |   |   |     |
|                        | Communication             | 0 | 3 | 7.5 |
| MECH1300               | Engineering Mechanics 1   | 4 | 0 | 10  |
| TEXT2101               | Fibre Science 2           | 0 | 4 | 10  |
| TEXT2201               | Textile Statistics        | 0 | 2 | 5   |
| TEXT2301               | Yarn Technology 1         | 6 | 0 | 15  |
| TEXT2401               | Fabric Technology 1       | 0 | 6 | 15  |
| General Educ           | cation subject/s          | 2 | 2 | 15  |
| Total HPW S            | ession 1 21               |   |   |     |
| Total HPW Session 2 22 |                           |   |   |     |
| Total Credit           | Points 117.5              |   |   |     |

|                       |                           | S1 | S2  | CP  |
|-----------------------|---------------------------|----|-----|-----|
| Year 3                |                           |    |     |     |
| ELEC0808              | Electrical Engineering 2E |    | 03  | 7.5 |
| MECH2300              | Engineering Mechanics 2A  |    | 3 0 | 7.5 |
| MECH2310              | Engineering Mechanics 2B  |    | 0 2 | 5   |
| MECH2600              | Fluid Mechanics 1         |    | 22  | 10  |
| MECH2700              | Thermodynamics 1          |    | 2 2 | 10  |
| TEXT3101              | Textile Structures 1      |    | 30  | 7.5 |
| TEXT3301              | Yarn Technology 2         |    | 06  | 15  |
| TEXT3401              | Fabric Technology 2       |    | 60  | 15  |
| TEXT3501              | Finishing Technology A    |    | 40  | 10  |
| TEXT3601              | Colour Science            |    | 30  | 7.5 |
| TEXT3602              | Colouration Technology    |    | 04  | 10  |
| General Educ          | ation subject/s           |    | 04  | 15  |
| Total HPW S           | ession 1 23               |    |     |     |
| <b>Total HPW S</b>    | ession 2 23               |    |     |     |
| Total Credit          | Points 120                |    |     |     |
| Year 4 (All O         | ntions)                   |    |     |     |
| APSE0002              | Social Issues in Applied  |    |     |     |
| A DECOUL              | Science                   | 2  | 0   | 5   |
| MANF0420              | Production Management or  | 6  | ŏ   | 15  |
| TEXT4202              | Textile Quality Control   | ō  | 2   | 5   |
| TEXT4702              | Textile Management*       | 6  | 0   | 15  |
| TEXT4701              | Textile Industry Studies  | 3  | 0   | 7.5 |
| TEXT4003              | Project                   | 5  | 9   | 35  |
| TEXT4013              | Seminar                   | 2  | 2   | 10  |
| TEXT4101              | Textile Structures 2      | 0  | 3   | 7.5 |
| TEXT4201              | Processing Laboratory     | 3  | 0   | 7.5 |
| TEXT4501              | Finishing Technology B    | 0  | 4   | 10  |
| Total HPW Se          | ession 1 21               |    |     |     |
| <b>Total HPW Se</b>   | ession 2 20               |    |     |     |
| <b>Total Credit F</b> | Points 102.5              |    |     |     |
|                       |                           |    |     |     |

......

- -

\*Co-Op Program students only.

# 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.

|  |  | н<br>S1 | PW<br>S2 | СР       |
|--|--|---------|----------|----------|
| Year 1                                     |  |         |          |          |
| CHEM1101<br>CHEM1401<br>ECON1101           | Chemistry 1A <i>or</i><br>Introductory Chemistry A<br>Microeconomics 1 <i>or</i> | 6       | 0        | 15       |
| ECON1103<br>ECON1102                       | Microeconomic Principles   | 3       | 0        | 15       |
| ECON1104<br>FIBR1101<br>MATH1131           | Macroeconomic Principles<br>Fibre Science 1<br>Mathematics 1A or                 | 0<br>4  | 3<br>0   | 15<br>10 |
| MATH1141<br>MATH1011<br>MATH1231           | Higher Mathematics 1A or<br>General Mathematics 1B<br>Mathematics 1B or          | 6       | 0        | 15       |
| MATH1021<br>PHYS1936                       | General Mathematics 1C<br>Physics 1 (Textile                                     | 0       | 6        | 15       |
| TEXT1101<br>TEXT1201                       | Management)<br>Science for Textiles<br>Introductory Textile                      | 0       | 4<br>2   | 10<br>5  |
|  | Technology   | 0       | 4        | 10       |
| Total HPW S<br>Total HPW S<br>Total Credit | ession 1 19<br>ession 2 19<br>Points 110   |         |          |          |
| Vear 2                                     |  |         |          |          |
| ACCT9001                                   | Introduction to  | 15      | 0        | 75       |
| ACCT9002                                   | Introduction to  | 0       | 1.5      | 7.5      |
| IROB1701                                   | Industrial Relations 1A and  | ŏ       | 3.5      | 15       |
| ACOT4504                                   | Management or  | 3       | 0        | 15       |
| ACC11501                                   | Accounting and Financial<br>Management 1A and                                    | 4       | 0        | 15       |
| ACCT1511                                   | Accounting and Financial<br>Management 1B  | 0       | 4        | 15       |
| FIBR2201                                   | Computing Applications   | 4       | 0        | 10       |
| MARK2012                                   | Marketing Fundamentals   | 4       | 0        | 15       |
| MARK2052                                   | Marketing Research   | 0       | 4        | 15       |
| TEXT2101                                   | Fibre Science 2  | 0       | 4        | 10       |
| TEXT2201                                   | Vern Technology 1  | 0       | 2        | 5        |
| TEXT2401                                   | Fahrie Technology I  | 0       | 0        | 15       |
| General Educ                               | ation subject/s  | 2       | 2        | 15       |
| Total HPW Se                               | ession 1 21  | -       | -        |          |
| Total HPW Se<br>Total Credit F             | Points 130   |         |          |          |
| Year 3                                     |  |         |          |          |
| TEXT3101                                   | Textile Structures 1   | З       | 0        | 7.5      |
| TEXT3301                                   | Yarn Technology 2  | 0       | 6        | 15       |
| TEXT3401                                   | Fabric Technology 2  | 6       | 0        | 15       |
| TEXT3501                                   | Finishing Technology A   | 4       | 0        | 10       |
| TEXT3601                                   | Colour Science   | з       | 0        | 7.5      |
| TEXT3801                                   | Textile Engineering  | 0       | 3        | 7.5      |
| 1EXT3602                                   | Colouration Technology   | 0       | 4        | 10       |
| Plus 2 Comme                               | erce electives selected from   |         |          |          |
| the following:                             | A  |         |          |          |
| AUG12522                                   | Accounting and Financial<br>Management 2A  | 4       | 0        | 15       |
| ACCT2542                                   | Accounting and Financial   |         |          | -        |
|  | Management 2B  | 0       | 4        | 15       |
| FINS2613                                   | Business Finance 2A  | З о     | r 3      | 15       |
| IROB1701                                   | Industrial Relations 1A  | 3.5     | 0        | 15       |

|                 |                                | HPW<br>S1 | 52    | СР   |  |  |
|-----------------|--------------------------------|-----------|-------|------|--|--|
| Year 3 (cont.)  |                                |           |       |      |  |  |
| ECOH2301        | Management Strategy and        |           |       |      |  |  |
|                 | Business Development           | 3         | 0     | 15   |  |  |
| ECON2103        | <b>Business and Government</b> | 0         | 3     | 15   |  |  |
| ECON2104        | Australian Macroeconomic       |           |       |      |  |  |
|                 | Policy                         | 3         | 0     | 15   |  |  |
| INFS1602        | Computer Information           |           |       |      |  |  |
|                 | Systems 1                      | 4 c       | or 4  | 15   |  |  |
| INFS2603        | Computer Information           |           |       |      |  |  |
|                 | Systems 2                      | 0         | 4     | 15   |  |  |
| LEGT7711        | Legal Environment of           |           |       |      |  |  |
|                 | Commerce                       | 3 0       | or 3  | 15   |  |  |
| LEGT7731        | Marketing and Distribution     |           |       |      |  |  |
|                 | Law                            | 0         | 3     | 15   |  |  |
| MARK3043        | International Marketing        | 0         | 3     | 15   |  |  |
| MARK3073        | Brand Management               | 4         | 0     | 15   |  |  |
| MARK3083        | Strategic Marketing            |           |       |      |  |  |
|                 | Management                     | 0         | 4     | 15   |  |  |
| or an alternati | ve as approved by the Head     | of De     | parti | nent |  |  |
| General Educa   | ation subject/s                | 0         | 4     | 15   |  |  |
| Total HPW Se    | Total HPW Session 1 19         |           |       |      |  |  |
| Total HPW Se    | ession 2 20                    |           |       |      |  |  |
| Total Credit P  | Points 117.5                   |           |       |      |  |  |

|                        |                          | HF<br>S1 | PW<br>S2 | СР  |
|------------------------|--------------------------|----------|----------|-----|
| Year 4                 |                          |          |          |     |
| APSE0002               | Social Issues in Applied |          |          |     |
|                        | Science                  | 2        | 0        | 5   |
| MANF0420               | Production Management or |          |          |     |
| TEXT4702               | Textile Management*      | 6        | 0        | 15  |
| TEXT4701               | Textile Industry Studies | 3        | 0        | 7.5 |
| TEXT4003               | Project                  | 5        | 9        | 35  |
| <b>TEXT4013</b>        | Seminar                  | 2        | 2        | 10  |
| <b>TEXT4101</b>        | Textile Structures 2     | 0        | 3        | 7.5 |
| TEXT4201               | Processing Laboratory    | 3        | 0        | 7.5 |
| TEXT4202               | Textile Quality Control  | 0        | 2        | 5   |
| <b>TEXT4501</b>        | Finishing Technology B   | 0        | 4        | 10  |
| Total HPW Session 1 21 |                          |          |          |     |
| Total HPW S            | ession 2 20              |          |          |     |
| Total Credit           | Points 102.5             |          |          |     |
|                        |                          |          |          |     |

\*Co-Op Program students only

# **Graduate Study**

# **Course Outlines**

The Department of Textile Technology 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 **2070** or Doctor of Philosophy **1060**.

## 5090 Textile Technology Graduate Diploma Course

### Graduate Diploma GradDip

The Graduate Diploma in Textile Technology course 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, comprising both formal lectures and laboratory work, may be taken as a one year full-time course or two-year part-time course. Candidates wishing to specialise in the theory and practice of yarn and fabric technology (engineering/physics orientation) should undertake the optional subjects TEXT5301, TEXT5302, TEXT5401 and TEXT5402. 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.

|          |                         |        |    | UF. |
|----------|-------------------------|--------|----|-----|
| TEXT5001 | Textile Technology      |        |    |     |
|          | Dissertation            | 1.5 1. | .5 | 7.5 |
| TEXT5003 | Textile Technology      | 1.5 1. | .5 | 7.5 |
| TEXT5101 | Fibre Science A         | 6 (    | )  | 15  |
| TEXT5102 | Fibre Science B         | 0 4    | \$ | 10  |
| TEXT5201 | Textile Quality Control | 0 2    | 2  | 5   |
|          |                         |        |    |     |

~ 0

Plus two electives per session (averaging not less than 9 hours per session), selected from the following:

| TEXT5301  | Yarn Technology A      | 5 | 0 | 12.5 |  |
|---|------------------------|---|---|------|--|
| TEXT5302  | Yarn Technology B      | 0 | 5 | 12.5 |  |
| TEXT5401  | Fabric Technology A    | 0 | 5 | 12.5 |  |
| TEXT5402  | Fabric Technology B    | 5 | 0 | 12.5 |  |
| TEXT5501  | Finishing Technology A | 5 | 0 | 12.5 |  |
| TEXT5502  | Finishing Technology B | 0 | 5 | 12.5 |  |
| TEXT5601  | Colour Science         | 4 | 0 | 10   |  |
| TEXT5602  | Dyeing Technology      | 0 | 4 | 10   |  |
| as an alternative as approved by the Head of Department |                        |   |   |      |  |

or an alternative as approved by the Head of Department

# Department of Wool and Animal Science

# Head of Department

Dr GE Robards

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 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 application of principles which are relevant to all aspects of pastoral production, including production and utilisation 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, rangeland 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.

# 3220 Wool and Pastoral Sciences Full-time Course

# **Bachelor of Science**

BSc

|                       |   | HF<br>S1 | W<br>S2 | СР   |
|-----------------------|---|----------|---------|------|
| Year 1<br>BIOS1101    | Evolutionary and Functional                     |          |         |      |
|                       | Biology   | 6        | 0       | 15   |
| BIOS1201              | Molecules, Cells and Genes                      | 0        | 6       | 15   |
| CHEM1101              | Chemistry 1A                                    | 6        | 0       | 15   |
| CHEM1201              | Chemistry 1B                                    | 0        | 6       | 15   |
| FIBR1001              | Natural Fibre Production                        | 0        | 6       | 15   |
| FIBR1101              | Fibre Science 1                                 | 4        | 0       | 10   |
| MATH1131              | Mathematics 1A or                               |          |         |      |
| MATH1141              | Higher Mathematics 1A or                        |          |         |      |
| MATH1011              | General Mathematics 1B                          | 6        | 0       | 15   |
| MATH1231              | Mathematics 1B or                               |          |         |      |
| MATH1241              | Higher Mathematics 1B or                        |          |         |      |
| MATH1021              | General Mathematics 1C                          | 0        | 6       | 15   |
| Total HPW Se          | ession 1 22                                     |          |         |      |
| Total HPW Se          | ession 2 24                                     |          |         |      |
| Total Credit P        | points 115                                      |          |         |      |
|                       |   |          |         |      |
| Year 2                |   |          |         |      |
| CHEM2929              | Fundamentals of Agricultural                    |          |         |      |
|                       | and Biological Chemistry                        | 6        | 0       | 15   |
| FIBR2201              | Computing Applications                          | 4        | 0       | 10   |
| WOOL2103              | Livestock Production 1                          | 2        | 2       | 10   |
| WOOL2203              | Agronomy  | З        | 6       | 22.5 |
| WOOL2303              | Agricultural Economics and                      |          |         |      |
|                       | Management                                      | 3        | 3       | 15   |
| WOOL2503              | Wool Science 1                                  | З        | 3       | 15   |
| WOOL2601              | Animal Physiology 1                             | 0        | 6       | 15   |
| MATH2819              | Statistics SA                                   | 2        | 2       | 10   |
| General Educa         | ation subject/s                                 | 2        | 2       | 15   |
| Total HPW Se          | ession 1 25                                     |          |         |      |
| Total HPW Se          | ession 2 24                                     |          |         |      |
| <b>Total Credit P</b> | Points 127.5                                    |          |         |      |
| Voor 2                |   |          |         |      |
|                       | Pastoral Agronomy                               | A        | ٨       | 20   |
| WOOL3203              | Animal Nutrition                                | 7        | 7       | 10   |
| WOOL3401              | Mool Science 2                                  | 2        | 3       | 15   |
| WOOL3503              | Animal Health and Wolfara                       | 3        | 0       | 75   |
| WOOL3701              |   | 3        | å       | 1.5  |
| WOOL3803              | Geneucs I<br>Disstatiation 1                    | د<br>۸   | 0       | 10   |
| WOOL3901              | Diusialistics I<br>Dringiales of Bioghostistary | 4        | 0       | 10   |
| BIOC2101              | Principles of Melocular                         | o        | 0       | 15   |
| BIOC2201              | Principles of Molecular                         | ~        | 6       | 15   |
|                       | Biology   | 0        | 0       | 10   |
| General Educa         | ation subject/s                                 | 2        | 2       | 15   |

|                    |                                 | HP<br>S1 | W<br>S2 | СР        |
|--------------------|---------------------------------|----------|---------|-----------|
| Year 3 (cont)      |                                 |          |         |           |
| Plus one of the    | five available options          |          |         |           |
| GEOG2021           | Introduction to Remote          | ^        |         | 15        |
| WOOL3111           | Livestock Production 2          | ŏ        | 3       | 7.5       |
| WOOL3211           | Crop Agronomy*                  | 0        | 3       | 7.5       |
| WOOL3221           | Range Management*               | 0        | 3       | 7.5       |
| WOOL3511           | Wool Marketing                  | 0        | 3       | 7.0<br>15 |
| W00L3521           | VVB0 Blobgy                     | 0        | U       | 10        |
| Total HPW Se       | ession 2 25                     |          |         |           |
| Total Credit P     | Points 130                      |          |         |           |
| *Available in alte | ernate years                    |          |         |           |
| Year 4             |                                 |          |         |           |
| APSE0002           | Social Issues in Applied        | -        | _       | _         |
| MOOL 4000          | Science                         | 2        | 0       | 20        |
| WOOL4003           | Seminar                         | 2        | 2       | 10        |
| Plus at least 1    | 4 hours each session of option  | nal s    | subje   | cts.      |
| Not more than      | one subject in each session r   | nay      | be      |           |
| chosen from C      | aroup B                         |          |         |           |
| Total HPW Se       | ession 1 24                     |          |         |           |
| Total Credit F     | Points 115                      |          |         |           |
|                    |                                 |          |         |           |
| Optional su        | bjects                          |          |         |           |
| Group A            |                                 |          |         |           |
| WOOL3111           | Livestock Production 2          | 0        | 3       | 7.5       |
| WOOL3211           | Crop Agronomy*                  | 0        | 3       | 7.5       |
| WOOL3221           | Wool Marketing                  | ŏ        | 3       | 7.5       |
| WOOL3521           | Wool Biology                    | ō        | 6       | 15        |
| WOOL4113           | Livestock Production 3          | 3        | 3       | 15        |
| WOOL4413           | Ruminant Nutrition              | 4        | 0       | 10        |
| WOOL4513           | Wool Science 3                  | 4        | 4       | 20        |
| WOOL4813           | Biostatistics 2                 | ō        | 4       | 10        |
| Some subject       | s may not be offered in all yea | rs.      |         |           |
| *Available in alte | ernate years.                   |          |         |           |
| Group B            |                                 |          |         |           |
| BIOS3061           | Plant Ecosystem Processes       | 6        | 0       | 15        |
| GEOG2021           | Introduction to Remote          | 0        | 4       | 10        |
| GE0G3032           | Bemote Sensing Application      | 54       | o<br>0  | 10        |
| MICR2201           | Introductory Microbiology       | 6        | õ       | 15        |
| Or such other      | subjects as may be approved     | by tł    | ne He   | ead of    |

Department.

# **Graduate Study**

# **Course Outlines**

The Department conducts a course which leads to the award of a Graduate Diploma in Wool and Pastoral Sciences **5081**.

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 **2081** or Doctor of Philosophy **1071**.

# Graduate Program in Wool and Pastoral Sciences

# 5081 Wool and Pastoral Sciences

### 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 Department

### **Full-time Course**

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

CP

| WOOL5113 | Livestock Production | 48 |
|----------|----------------------|----|
| WOOL5213 | Range Management     | 12 |
| WOOL5513 | Wool Science         | 48 |
| WOOL5813 | Animal Breeding      | 32 |
| WOOL5913 | Quantitative Methods | 32 |
|          |                      |    |

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

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 8025 Graduate Diploma in Rangeland Management 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 120 credit points for the Masters degree or 96 credit points 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 36 credit point Project. Students then complete the requirements for their Course by selecting the appropriate number of credit points 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

# Master of Applied Science MAppSc

| Compulsory S         | Subjects                               | СР |
|----------------------|--|----|
| WOOL5213             | Range Management                       | 12 |
| GEOG9320             | Soil Degradation and Conservation      | 12 |
| GEOG9509             | Project or                             | 36 |
| WOOL5223             | Project                                | 36 |
| <b>Optional Subj</b> | ects                                   |    |
| Choose subject       | ts totalling 60 credit points from the |    |
| following list:      |  |    |
| BIOS3014             | Ecological Studies in Arid Lands       |    |
|                      | Management                             | 15 |
| CIVL9875             | Hydrological Processes                 | 12 |
| ECON2109             | Economics of Natural Resources         | 15 |
| GEOG9130             | Soil Studies for Arid Lands Management | 12 |
| GEOG9150             | Remote Sensing Applications            | 12 |
| GEOG9240             | Principles of Geographic Information   |    |
|                      | Systems                                | 12 |
| GEOG9300             | Vegetation Management                  | 12 |
| GEOG9310             | River Management                       | 12 |
| WOOL5113             | Livestock Production                   | 48 |

Additional subjects may be substituted with the permission of the Head of Department.

# 5025 Rangeland Management

# Graduate Diploma GradDip

| Compulsory | Subjects                          | CP |
|------------|-----------------------------------|----|
| GEOG9320   | Soil Degradation and Conservation | 12 |
| WOOL5213   | Range Management                  | 12 |

### **Optional Subjects**

Choose subjects totalling 72 credit points, to include at least 36 credit points of graduate level subjects.

| 12    |
|-------|
| 12    |
| 15    |
| 15    |
| 15    |
| 15    |
| 15    |
| nt 12 |
|       |
| 12    |
| 12    |
| 12    |
| 10    |
| 7.5   |
| 20    |
| 15    |
| 48    |
|       |

\*Undergraduate level subjects. Additional subjects may be substituted with the permission of the Head of Department.

# **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.

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 Department.

### **APSE0002**

Social Issues in Applied Science Staff Contact: Prof Jean Cross CP5 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.

### FIBR1001

Natural Fibre Production Staff Contact: A/Prof David Cottle CP15 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 CP10 S1 L2 T2

Fibre classification and raw materials. Polymer requirements for fibre formation. Introduction to fibre structure and morphology. Physical and chemical properties of textile fibres. Production of natural and man-made fibres. Necessary and desirable attributes of textile fibres. Fibre mechanical properties, structure and physical properties of wool keratin. Laboratory classes on fibre identification and fibre microscopy.

### FIBR2201

Computing Applications Staff Contact: A/Prof John James CP10 S1 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. TEXT1101

Science for Textiles Staff Contact: Dr Shantha David CP5 S2 L1 T1

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 CP10 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 CP10 S2 L2 T2 Prerequisite: FIBRE1101/TEXT1101

Fibre microscopy. Electron microscopy. Fibre reflection and lustre. Morphological and fine structure of fibres. X-ray Crystallography. Polymer crystallisation. Molecular structure of proteins. Optical properties and fibre orientation. Infra-red spectroscopy. Fibre rheology. Mechanical properties. Addition and condensation polymerization. Chemical constitution and reactivity of man-made fibres. Introduction to high technology fibres. Laboratory experiments on fibre and electron microscopy, x-ray diffraction and infra-red spectroscopy, fibre structure and viscoelasticity.

#### **TEXT2201**

Textile Statistics Staff Contact: Dr John Curiskis CP5 S2 L2

Application of mathematical techniques to textile data processing and analysis. Probability theory, distribution functions, tests of significance. Analysis of variance, regression analysis. Introduction to computer statistical packages.

### TEXT2301

Yarn Technology 1 Staff Contact: Dr Xungai Wang CP15 S1 L3 T3 Prerequisite: TEXT1201

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; leveling of slivers.

# **TEXT2401**

Fabric Technology 1 Staff Contact: Dr John Curiskis CP15 S2 L3.5 T2.5 Prerequisite: TEXT1201

Principles of weaving. Mechanisms of shedding, picking, and beating up. Secondary and auxiliary mechanisms of looms. Cam, dobby and jacquard shedding. Shuttle, projectile, rapier and jet weft insertion. Multiphase weaving; circular weaving. Woven cloth construction principles and weave representation; basic weave structures. Leno and narrow fabric weaving. Woven pile fabric constructions; tufting. Yarn preparation for weaving. Mechanics of woven fabric formation. Introduction to knitting technology.

### **TEXT3101**

Textile Structures 1 Staff Contact: Prof Ron Postle CP7.5 S1 L1 T2 Prerequisite: FIBR1101/TEXT1101

Fibrous structures and textile assemblies. Fibre friction and visco-elasticity. Lubrication. Static electrification of textiles. Yarn structures. Fibre migration in yarns. Mechanics of continuous filament yarns, staple-fibre yarns, plied and textured yarns. Fabric testing; structure and dimensions; tensile strength; tear strength; fabric abrasion. Fabric low-stress mechanical and surface properties. Drape and handle. Fabric tailorability. Laboratory experiments on yarn and fabric structure, mechanical and physical properties.

### **TEXT3301**

Yarn Technology 2 Staff Contact: Dr Xungai Wang CP15 S2 L3 T3 Prerequisite: TEXT1201

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.

### **TEXT3401**

Fabric Technology 2 Staff Contact: Dr John Curiskis CP15 S1 L3.5 T2.5 Prerequisite: TEXT1201

Principles of knitting. Techniques of loop formation in weft and warp knitting; essential machine mechanisms. Knitted cloth construction principles and knitted structure representations; basic knitted structures. Techniques of jacquard needle selection and loop transfer for extended design effects in weft knitting; derivative weft knitted structures. Shaped weft knitted structures, including fully-fashioned knitting, hosiery manufacture, integral knitting techniques. Use of multiple guide bars, part-set threading, and auxiliary mechanisms for extended design effects in tricot and raschel warp knitting; derivative warp knitted structures. Double needle bed warp knitting. Mechanics of knitted fabric formation. Stitch-bonded and non-woven fabric manufacture.

### TEXT3501 Finishing Technology A

Staff Contact: Dr Shantha David CP10 S1 L2 T2 Prerequisite: FIBR1101/TEXT1101

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. Practical exercises in fabric bleaching, wool milling and shrinkproofing. Analysis of hard water by tritation.

## **TEXT3601**

Colour Science Staff Contact: Prof Mike Pailthorpe CP7.5 S1 L2 T1

Aspects of colour, colour mixing and colour vision. Absorptiometry, spectrophotometry and tristimulus colorimetry. Measurement and specification of colour and colour difference. Applications of colour measurement. Computer aided colour match prediction.

### **TEXT3602**

Colouration Technology Staff Contact: Prof Mike Pailthorpe CP10 S2 L2 T2 Prerequisite: FIBR1101/TEXT1101

Classification of dyes and pigments and their methods of application. General properties of dyes, dyeing auxiliaries and after treatments. Assessment of colourfastness properties of dyes and pigments. Mill water supplies and their treatment. Aspects of dyehouse effluent treatment. Textile dyeing machinery. Recent developments in dyeing and printing technology.

### TEXT3801

Textile Engineering Staff Contact: Prof Ross Griffith CP7.5 S2 L2 T1 Prerequisite: TEXT1201

Applied Electricity. Illumination design. Introduction to process control. Thermodynamic principles and applications in textile processing including first and second laws, states and processes, fluid properties. Properties and use of steam. Air conditioning. Heat transfer. Introduction to fluid mechanics. Energy utilisation in textile processes.

### **TEXT4003**

Project Staff Contact: Prof Ron Postle CP35 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.

### TEXT4013

Seminar Staff Contact: Prof Mike Pailthorpe CP10 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.

## TEXT4101

Textile Structures 2 Staff Contact: Prof Ron Postle CP7.5 S2 L1 T2 Prerequisite: FIBR1101/TEXT1101

Physical equilibration of textile materials, ageing and annealing. Structural mechanics of woven, knitted and non-woven fabrics. Composite materials, fabric membrane properties. Clothing mechanics and tailorability. Fabric rheology. Wrinkling properties. Clothing comfort and physiology. Thermal insulation. Diffusion of moisture. Heat and mass transfer. Capillary action of textiles. Laboratory experiments on textile equilibration, tailorability of textile materials, heat and moisture transfer in textiles.

### **TEXT4201**

### Processing Laboratory

Staff Contact: Dr John Curiskis CP7.5 S1 T3

Students undertake a project involving the design, production and assessment of textile products. Such as: rib jacquard outer fabric, towelling, printed tea towels, woven furnishing fabric, raschel outer wear fabric, etc.

### **TEXT4202**

Textile Quality Control Staff Contact: Prof Mike Pailthorpe CP5 S2 L1 T1 Prerequisite: TEXT2201

User-serviceability testing. Fibre content and carelabelling. Process and quality control. Consumer problems.

### **TEXT4501**

Finishing Technology B Staff Contact: Dr Shantha David CP10 S2 L2 T2 Prerequisite: FIBR1101/TEXT1101

Wet and dry fabric finishing. The application of special finishes including flame retardant finishes, crease resistant and antistatic finishes, etc. Fabric setting Dimensional stability and its measurement. The drying of textile materials. Recent developments in finishing technology.

### TEXT4701

Textile Industry Studies Staff Contact: Prof Ross Griffith CP7.5 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. Environmental considerations in relation to pollution from the textile industry. Waste water treatment methods.

#### TEXT4702 Textile Management\*

Staff Contact: Dr John Curiskis CP15 S1 T6

\*Co-Op Students only

Selected readings in the Management of manufacturing systems with particular reference and examples from specific manufacturing enterprises.

### **TEXT5001**

Textile Technology Dissertation Staff Contact: Prof Mike Pailthorpe CP7.5 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 CP7.5 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: Dr Shantha David CP15 S1 L4 T2

Fibre classification and raw materials. Polymer requirements for fibre formation. Introduction to fibre structure and morphology. Physical and chemical properties of textile fibres. Production of natural and man-made fibres. Necessary and desirable attributes of textile fibres. Fibre mechanical properties, structure and physical properties of wool keratin. Laboratory classes on fibre identification and fibre microscopy.

### TEXT5102

Fibre Science B Staff Contact: Prof Ron Postle CP10 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 orientation. Infra-red spectroscopy. Fibre rheology. Mechanical properties. Moisture sorption and swelling. Addition and condensation polymerization. Chemical constitution and reactivity of man-made fibres. Introduction to high technology fibres. Laboratory experiments on fibre and electron microscopy, x-ray diffraction and infra-red spectroscopy, fibre structure and viscoelasticity.

### **TEXT5201**

Textile Quality Control Staff Contact: Prof Mike Pailthorpe CP5 S2 L1 T1

User-serviceability testing. Fibre content and carelabelling. Process and quality control. Consumer problems.

### **TEXT5301**

Yarn Technology A Staff Contact: Dr Xungai Wang CP12.5 S1 L3 T3

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 CP12.5 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 guality; automation. Measurement of yarn properties.

### **TEXT5401**

Fabric Technology A Staff Contact: Dr John Curiskis CP12.5 S2 L3.5 T1.5

Principles of weaving. Mechanisms of shedding, picking, and beating up. Secondary and auxiliary mechanisms of looms. Cam, dobby and jacquard shedding. Shuttle, projectile, rapier and jet weft insertion. Multiphase weaving, circular weaving. Woven cloth construction principles and weave representation; basic weave structures. Leno and narrow fabric weaving. Woven pile fabric constructions; tufting. Yarn preparation for weaving. Mechanics of woven fabric formation.

### **TEXT5402**

Fabric Technology B Staff Contact: Dr John Curiskis CP12.5 S1 L3.5 T1.5

Principles of knitting. Techniques of loop formation in weft and warp knitting; essential machine mechanisms. Knitted cloth construction principles and knitted structure representations; basic knitted structures. Techniques of jacquard needle selection and loop transfer for extended design effects in weft knitting; derivative weft knitted structures. Shaped weft knitted structures, including fully-fashioned knitting, hosiery manufacture, integral knitting techniques. Use of multiple guide bars, part-set threading, and auxiliary mechanisms for extended design effects in tricot and raschel warp knitting; derivative warp knitted structures. Double needle bed warp knitted. Mechanisms of knitted fabric formation. Stitch-bonded and non-woven fabric manufacture.

### **TEXT5501**

### Finishing Technology A Staff Contact: Dr Shantha David

CP12.5 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. Practical exercises in bleaching, wool milling and shrinkproofing. Analysis of hard water by tritation.

### TEXT5502

Finishing Technology B Staff Contact: Dr Shantha David

CP12.5 S2 L2 T3

Wet and dry fabric finishing. The application of special finishes including flame retardant finishes, crease resistant and antistatic finishes, etc. Fabric setting. Dimensional stability and its measurement. The drying of textile materials. Recent developments in finishing technology.

### **TEXT5601**

Colour Science Staff Contact: Prof Mike Pailthorpe CP10 S1 L2 T1

Aspects of colour, colour mixing and colour vision. Absorptiometry, spectrophotometry and tristimulus colorimetry. Measurement and specification of colour and colour difference. Applications of colour measurement. Computer aided colour match prediction.

### **TEXT5602**

Colouration Technology Staff Contact: Prof Mike Pailthorpe CP10 S2 L2 T2

Classification of dyes and pigments and their methods of application. General properties of dyes, dyeing auxiliaries and after-treatments. Assessment of colour-fastness properties of dyes and pigments. Mill water supplies and their treatment. Aspects of dye-house effluent treatment. Textile printing methods. Textile dyeing machinery. Recent developments in dyeing and printing technology.

### WOOL2103

Livestock Production 1 Staff Contact: A/Prof David Cottle CP10 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 CP22.5 S1 L2 T1 S2 L3 T3

Agricultural climatology, soil science, and soil conservation. Pastures in land use and land development. Principles of tillage, crop rotation, irrigation, conservation of fodder and fertiliser usage. Weeds and weed control. Practical work in the systematics of selected plant families.

### WOOL2303

Agricultural Economics and Management 1 Staff Contact: Mr Steve Filan CP15 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 CP15 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: Dr Geoff Robards CP15 S2 L3 T3 Prerequisite: BIOS1201

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 gastro-intestinal tract and of the kidney. Heat tolerance and climatic adaptation.

### WOOL3111

Livestock Production 2 Staff Contact: Dr Doug Murray CP7.5 S2 L2 T1 Prerequisite: WOOL2103

Feed lot production of cattle as an intensive system and the factors affecting output such as environmental conditions, nutrition and disease. Establishment and management of a feed lot. Use of metabolisable and net energy requirements to calculate dry matter intakes of feeds of varying nutritive value for different productive states.

### WOOL3203

Pastoral Agronomy Staff Contact: Dr Gordon King CP20 F L3 T1 Prerequisite: WOOL2203

Pasture ecology. Establishment, management and utilisation of pastures and fodder crops. Pasture-animal relationships, stocking rates, mixed stocking. Vegetation management in arid and semi-arid areas. Pasture evaluation and pasture research techniques.

### WOOL3211

Crop Agronomy Staff Contact: Dr Gordon King CP7.5 S2 L2 T1 Prerequisite: WOOL2203 Note/s: Available in alternate years.

Field crop production associated with the pastoral industries. Crop physiology. Cropping practices. Pests and diseases.

# WOOL3221 Range Management

Staff Contact: Dr Gordon King CP7.5 S2 L1 T2 Co or Prerequisite: WOOL3203

Basic range ecology and rangeland ecosystems. Plant physiology, growth and development of rangeland plants. Rangeland management practices. Monitoring of long-term trends in productivity. Applications of remote sensing and ground truth sampling. Wild life resources and feral animals and their management. Sheep and beef cattle production in arid and semi-arid environments. Administration of rangelands (e.g. the functions of the Western Lands Commission, the National Parks and Wildlife Service, and the Soil Conservation Service in New South Wales). Involves one week of instruction at Fowlers Gap Research Station.

### WOOL3401

Animal Nutrition Staff Contact: Dr Geoff Robards CP10 S2 L3 T1

Composition and classification of foodstuffs and pastures. Digestion absorption and metabolism of carbohydrates, proteins, fats, mineral and vitamins. Digestibility of feedstuffs. Nutrient and energy balances and requirements of livestock. Feeding standards and the quantitative application of nutritional data with particular reference to Australian conditions. 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 CP15 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: Dr Peter Auer CP7.5 S2 L2 T1

Wool marketing systems; comparison with other countries, modelling. Wool commerce; financial factors. Information systems. Future directions.

# WOOL3521

Wool Biology Staff Contact: Dr Peter Auer CP15 S2 L3 T3 Prerequisite: FIBR1001, BIOS1201

The study of the biology of the skin and the fleece which relates the characteristics of the wool follicle and fibre to the production, technology and processing of wool. Follicle morphology and function; the components of wool; development of wool follicles; follicle physiology; regulation of follicle function and fibre production; manipulation of follicle function; individual vs populations of follicles and fibres; physical characteristics of the fleece; wool and other textile fibres.

### WOOL3701

# Animal Health and Welfare 1

Staff Contact: A/Prof John Kennedy CP7.5 S1 L2 T1 Prerequisite: WOOL2103

Managerial control of grazing livestock health and welfare. The concept of economic approach to animal health. Introductory immunology. Skin health in sheep and cattle. Control of external parasites, particularly by insecticides. Reproductive health in sheep and cattle. Internal parasites. Legal and Public Health responsibilities; Acts of Parliament relating to animal health and welfare.

# WOOL3803

Genetics 1 Staff Contact: A/Prof John James

CP15 F L2 T1

Mendelian inheritance. Chromosomes, linkage and the physical basis of heredity. Gene action in physiology and development. Elements of molecular genetics. Principles of quantitative genetics, strength of inheritance and relationships. Selection and crossbreeding. Genetics applied to animal and plant improvement. Applications of genetics in sheep and wool production.

#### WOOL3901 Biostatistics 1 Staff Contact: A/Prof. John

Staff Contact: A/Prof John James CP10 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: Dr Geoff Robards CP30 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: Dr Geoff Robards CP10 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: Dr Geoff Robards CP15 CP15 F L1 T2

Principles of livestock production applied to reproduction and fertility; growth and development. The meat industry. Carcass conformation and composition. Pre and post mortem factors affecting meat quality. Meat marketing.

### WOOL4413

Ruminant Nutrition Staff Contact: Dr Geoff Robards CP10 S1 L2 T2 Prerequisite: WOOL3401

Utilisation of metabolisable energy: protein digestion and utilisation; 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 CP20 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 CP20 F L2 T2 Prerequisite: WOOL3803

Genetic structure of populations. Forces causing genetic change. Partition of genetic and phenotypic variation. Resemblance between relatives and estimation of genetic parameters. Direct and correlated selection responses. Aids to selection and selection indexes. Inbreeding and genetic drift. Genotype environment interaction. Heterosis and its utilisation. Interaction of natural and artificial selection. Limits of selective progress. Applications of molecular genetics.

### WOOL4911

Biostatistics 2 Staff Contact: A/Prof John James CP10 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.

### WOOL5113

Livestock Production Staff Contact: Dr Geoff Robards CP48 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 CP12 F L1 T3

Objectives in the utilisation and management of rangelands. Ecology of rangelands, with emphasis on the impact of grazing. Degradation of rangelands. Morphology and physiology of range plants in relation to management. Grazing management. Burning as a management practice. Assessment of range condition and trend. Applications of remote sensing. Sheep and cattle production in arid and semiarid environments. Native and feral animals and their management. Diet selection of different species. Administration of rangelands. Assignment work and field studies, including a week at Fowlers Gap Arid Zone Research Station.

### WOOL5223

#### Project in Range Management Staff Contact: Dr Gordon King

CP36 F T9

A theoretical and or experimental investigation of some aspect of management of rangelands.

### WOOL5513 Wool Science Staff Contact: A/Prof David Cottle CP48 F L2 T4

Biology and histology of fibre growth and fibre structure. Wool physics and chemistry. Objective characteristics of the Australian wool clip. Preparation for sale, measurement, specification, valuation and marketing of wool. Wool metrology and conditioning house procedures. Fibre parameters in processing.

### WOOL5813 Animal Breeding

Staff Contact: A/Prof John James CP32 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 and molecular genetics.

### WOOL5913

### **Quantitative Methods**

Staff Contact: A/Prof John James CP32 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.

# School of Geography

Head of School Associate Professor MD Fox

# Administrative Officer

Mr P Dulhunty

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.

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. These vocationally-oriented Applied Geography programs 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 well-being. These courses provide elective specialisations 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).

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 **8027.1000**; Masters and Diploma courses in Remote Sensing **8047.2000** and **5047.2000**, Master in Environmental Management **8047.3000** and may undertake projects in the School as part of the Master of Environmental Studies degree **8045**. In addition the School welcomes enquiries from graduates who are interested in research leading to the award of the degrees of Doctor of Philosophy or Master of Science.

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

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

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.

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**.

# Applied Geography Full-time Courses

LIDW

00

Bachelor of Science BSc

# 3010.1000 Applied Physical Geography

|                |                                | S1  | S2 | UF |
|----------------|--------------------------------|-----|----|----|
| Year 1         |                                |     |    |    |
| GEOG1000       | Field Project 1                | 2   | 2  | 10 |
| GEOG1043       | Data Processing Systems        | 4   | 0  | 10 |
| GEOG1044       | Data Display Systems           | 0   | 4  | 10 |
| GEOG1062       | Australia and Global           |     |    |    |
|                | Geographies; Integration       |     |    |    |
|                | and Divergence                 | 4   | 0  | 15 |
| GEOG1073       | Environmental Processes        |     |    |    |
|                | and Analysis                   | 0   | 6  | 15 |
| MATH1131       | Mathematics 1A or              |     |    |    |
| MATH1141       | Higher Mathematics 1A or       |     |    |    |
| MATH1011       | General Mathematics 1B         | 6   | 0  | 15 |
| MATH1231       | Mathematics 1B or              |     |    |    |
| MATH1241       | Higher Mathematics 1B or       |     |    |    |
| MATH1021       | General Mathematics 1C         | 0   | 6  | 15 |
|                | and an additional 2            |     |    |    |
|                | level 1 subjects: recommend    | led |    |    |
| and either     |                                |     |    |    |
| BIOS1101       | Evolutionary and Functional    |     |    |    |
|                | Biology and                    | 0   | 6  | 15 |
| BIOS1201       | Molecules, Cells and Genes     | 6   | 0  | 15 |
| or             |                                |     |    |    |
| GEOL1101       | Geological Processes and       | 6   | 0  | 15 |
| GEOL1201       | Geological Environments        | 0   | 6  | 15 |
| Total HPW Se   | ssion 1 22                     |     |    |    |
| Total HPW Se   | ession 2 24                    |     |    |    |
| Total Credit F | Points 120                     |     |    |    |
|                | 120                            |     |    |    |
| Vear 2         |                                |     |    |    |
| GEOG2000       | Field Project 2                | 15  | 15 | 10 |
| GEOG2013       | Geographic Data Analysis       | 4   | 0  | 15 |
| GEOG2021       | Introduction to Remote Sensing | 10  | Ă  | 15 |
| GEOG2025       | Biogeography                   | , ŭ | 4  | 15 |
| GEOG2051       | Soils and Landforms            | ă   | ň  | 15 |
| GEOG3123       | Applied Geographic             | -   | Ŭ  | 15 |
|                | Information Systems            | 0   | ٨  | 15 |
| GEOG3211       | Australian Environments and    | 0   | 7  | 15 |
|                | Natural Resources              | 4   | 0  | 15 |
| and either     | Natural nesources              | 4   | 0  | 15 |
| GEOL2011       | Mineralogy and Igneous         |     |    |    |
|                | Petrology and Igneous          | 6   | 0  | 15 |
| GEOI 2022      | Petrology and Structural       | 0   | 0  | 15 |
|                | Geology                        | 0   | 6  | 46 |
|                | acology                        | U   | U  | 15 |
|                |                                |     |    |    |

|                                   |  | HF<br>S1 | ₽₩<br>S2    | СР             |
|-----------------------------------|--|----------|-------------|----------------|
| or any two of th<br>BIOS2011      | he following<br>Evolutionary and                     | 6        | 0           | 15             |
| BIOS2051<br>BIOS2061              | Flowering Plants                                     | 6<br>0   | 0<br>0<br>6 | 15<br>15<br>15 |
| and for all stud<br>General Educa | ents<br>ition subject/s                              | 2        | 2           | 15             |
| Total HPW Se                      | ssion 1 21.5<br>ssion 2 21.5                         |          |             |                |
| Total Credit P                    | oints 145  |          |             |                |
| Year 3<br>GEOG3000                | Field Project 3                                      | 1.5      | 1.5         | 15             |
| GEOG3011                          | Pedology   | 4        | 0           | 15             |
| GEOG3025                          | Geomorphology  | 0        | 4           | 15             |
| GEOG3032                          | Remote Sensing Applications                          | 4        | 0           | 15             |
| GEOG3062                          | Environmental Change<br>Project Design & Formulation | 4        | 3           | 10             |
| GEOG3062                          | Geographic Information                               | Ű        | Ŭ           |                |
| 02000142                          | Systems Applications                                 | 0        | 4           | 15             |
| and one of the                    | following  |          |             |                |
| CHEM1101                          | Chemistry A  | 6        | 0           | 15             |
| CHEM1401                          | Introductory Chemistry A                             | 6        | 0           | 15             |
| BIOS3051                          | Insect Diversity and                                 |          |             |                |
|                                   | Management   | 6        | 0           | 15             |
| BIOS3061                          | Plant Ecosystem Processes                            | 6        | 0           | 15             |
| BIOS3071                          | Conservation Biology and                             | ~        | ~           | 45             |
| <b>BIO 00444</b>                  | Biodiversity   | ю        | U           | 15             |
| BIOS3111                          | Ecology  | ٥        | 6           | 15             |
| GEOL 7321                         | Geology for Geomorphologis                           | sts      | Ŭ           |                |
| GLOCIOLI                          | and Pedologists                                      | 2        | 4           | 15             |
| and for all stud                  | lents  |          |             |                |
| General Educa                     | ation subject/s                                      | 2        | 2           | 15             |
| Total HPW Se                      | ssion 1 17.5/19.5                                    |          |             |                |
| Total HPW Se                      | ssion 2 16.5/18.5                                    |          |             |                |
| Total Credit P                    | Points 130   |          |             |                |
| Year 4                            |  |          |             |                |
| GEOG3042                          | Environmental Impact                                 |          |             |                |
|                                   | Assessment   | 4        | 0           | 15             |
| GEOG4010                          | Field Project 4                                      | 0        | 6           | 20             |
| GEOG4031                          | Project  | 8        | 8           | 40             |
| GEOG4042                          | Advanced Spatial Analysis*                           | 4        | <b>4</b>    | 10             |
| GEOG4052                          | Advanced Environmental                               | 4        | 0           | 10             |
| 02004002                          | Analysis*  | 4        | 0           | 15             |
|                                   | -  |          |             |                |
| Total HPW Se                      | ession 1 20  |          |             |                |
| Total HPW Se                      | ession 2 18  |          |             |                |
| I otal Credit F                   | oints 115  |          |             |                |

\*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.

# 3010.2000 Applied Economic Geography

|              |                              | HP<br>S1 | W<br>S2 | СР    |
|--------------|------------------------------|----------|---------|-------|
| Year 1       |                              |          |         |       |
| GEOG1000     | Field Project 1              | 2        | 2       | 10    |
| GEOG1022     | Locational Processes         | 0        | 4       | 10    |
| GEOG1031     | Environmental Processes      | Ō        | 4       | 15    |
| GEOG1049     | Data Processing Systems      | 4        | 0       | 10    |
| GEOG1044     | Data Display Systems         | 0        | 4       | 10    |
| GEOG1062     | Australia and Global         |          |         |       |
| 0200.002     | Geographics: Integration     |          |         |       |
|              | and Divergence               | 4        | 0       | 15    |
| MATH1131     | Mathematics 1A or            |          |         |       |
| MATH1141     | Higher Mathematics 1A or     |          |         |       |
| MATH1011     | General Mathematics 1B       | 6        | 0       | 15    |
| MATH1231     | Mathematics 1B or            |          |         |       |
| MATH1241     | Higher Mathematics 1B or     |          |         |       |
| MATH1021     | General Mathematics 1C       | 0        | 6       | 15    |
|              | and an additional 2          |          |         |       |
|              | level 1 subjects: recommend  | ed a     | nd e    | ither |
| ECON1101     | Microeconomics 1 and         | 3        | 0       | 15    |
| ECON1102     | Macroeconomics 1             | 0        | 3       | 15    |
| or           |                              |          |         |       |
| ECON1103     | Microeconomic Principles and | 13       | 0       | 15    |
| ECON1104     | Macroeconomic Principles     | 0        | 3       | 15    |
| Total HPW S  | ession t 19                  |          |         |       |
| Total HPW S  | ession 2 23                  |          |         |       |
| Total Credit | Points 130                   |          |         |       |
|              |                              |          |         |       |
| Year 2       |                              |          | 4 5     | 10    |
| GEOG2000     | Field Project 2              | 1.5      | 1.5     | 10    |
| GEOG2013     | Geographical Data Analysis   | 4        |         | 10    |
| GEOG2052     | Project in Spatial Analysis  | 4        | ÷.      | 15    |
| GEOG2061     | Transport and Land Lico      | 7        | 4       | 15    |
| GEOG2071     | Australian Social and        | U        | 4       | 15    |
| GEOG2092     | Australian Social and        |          | 0       | 15    |
| 05000100     | Applied Geographic           | 4        | v       | 15    |
| GEOG3123     | Applied Geographic           | 0        | Λ       | 15    |
| FOONISTOS    | Rusiness and Covernment      | Ň        | 2       | 15    |
| ECON2103     | Australian Macrosconomic     | 0        | 5       | 10    |
| ECON2104     | Reliev                       | 3        | Δ       | 15    |
|              | Folicy                       | 2        | 2       | 15    |
| General Educ |                              | 2        | 2       | 15    |
| Total HPW S  | ession 1 18.5                |          |         |       |
| Total HPW S  | ession 2 18.5                |          |         |       |
| Total Credit | Points 140                   |          |         |       |

|                   |                                | HF<br>S1 | w<br>S2 | СР   |
|-------------------|--------------------------------|----------|---------|------|
| Year 3            |                                |          |         |      |
| GEOG3000          | Field Project 3                | 1.5      | 1.5     | 15   |
| GEOG3041          | Mathematical Methods for       |          |         |      |
|                   | Spatial Analysis               | 4        | 0       | 15   |
| GEOG3082          | Project Design and             |          |         |      |
|                   | Formulation                    | 0        | 3       | 10   |
| GEOG3101          | Sample Surveys and             |          |         |      |
|                   | Questionnaire Design           | 4        | 0       | 10   |
| GEOG3166          | Place and Politics of Identity | 0        | 4       | 15   |
| GEOG3172          | Spatial Population Analysis    | 0        | 4       | 15   |
| plus ONE of th    | ne following                   |          |         |      |
| GEOG2021          | Introduction to Remote         |          |         |      |
|                   | Sensing                        | 0        | 4       | 15   |
| GEOG3142          | Geographic Information         |          |         |      |
|                   | SystemsApplications            | 0        | 4       | 15   |
| GEOG3192          | Urban and Regional             |          |         |      |
|                   | Development                    | 0        | 4       | 15   |
| GEOG3333          | Special Topic                  | 2        | 2       | 15   |
| GEOG3334          | Special Research Methods       | 2        | 2       | 15   |
| plus TWO of t     | he following:                  |          |         |      |
| ECON2109          | Economics of Natural           |          |         |      |
|                   | Resources                      | 3        | 0       | 15   |
| ECON2111          | The Economics of Global        |          |         |      |
|                   | Interdependence*               | 0        | 3       | 15   |
| ECON2115          | Japanese International         |          | _       |      |
|                   | Economic Relations*            | 0        | 3       | 15   |
| ECON2116          | Japanese Economic Policy*      | 3        | 0       | 15   |
| ECON2117          | Economics of Lourism           | 3        | 0       | 15   |
| ECON2127          | Environmental Resources an     | d        |         |      |
|                   | Cost Benefit Analysis          | 0        | 3       | 15   |
| ECON3115          | Economics of Developing        |          |         |      |
| and for all ature | Countries                      | 3        | 0       | 15   |
| General Educe     |                                |          | ~       | 4.00 |
| General Euuca     | ation subject/s                | 4        | U       | 15   |
| Total HPW Se      | ssion 1 16.5/17.5              |          |         |      |
| Total HPW Se      | ssion 2 18.5/19.5              |          |         |      |
| Total Credit P    | oints 140                      |          |         |      |

\*Approved as alternatives for ECON2108 Industry Economics and Australian Industrial Policy and ECON3115 Economics of Developing Countries, neither of which is currently offered.

| Year 4                |                            |   |   |    |
|-----------------------|----------------------------|---|---|----|
| GEOG3042              | Environmental Impact       |   |   |    |
|                       | Assessment                 | 4 | 0 | 15 |
| GEOG4010              | Field Project 4            | 0 | 6 | 20 |
| GEOG4031              | Project                    | 8 | 8 | 40 |
| GEOG4042              | Practical Applications     | 0 | 4 | 10 |
| GEOG4052              | Advanced Spatial Analysis* | 4 | 0 | 15 |
| GEOG4062              | Advanced Environmental     |   |   |    |
|                       | Analysis*                  | 4 | 0 | 15 |
| Total HPW Se          | ession 1 20                |   |   |    |
| <b>Total HPW Se</b>   | ession 2 18                |   |   |    |
| <b>Total Credit P</b> | oints 115                  |   |   |    |

\*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.

# 3010.3000 Human and Physical Resources Physical

|  |   | HI<br>S1 | PW<br>S2 | СР |
|--|---|----------|----------|----|
| Year 1 (same                                   | as for 3010.1000)                         |          |          |    |
| GEOG1000                                       | Field Project 1                           | 2        | 2        | 10 |
| GEOG1043                                       | Data Processing Systems                   | 4        | 0        | 10 |
| GEOG1044                                       | Data Display Systems                      | 0        | 4        | 10 |
| GEOG1062                                       | Australia and Global                      |          |          |    |
|  | Geographies: Integration                  |          |          |    |
|  | and Divergence                            | 4        | 0        | 15 |
| GEOG1073                                       | Environmental Processes                   |          |          |    |
|  | and Analysis                              | 0        | 6        | 15 |
| MATH1131                                       | Mathematics 1A or                         |          |          |    |
| MATH1141                                       | Higher Mathematics 1A or                  |          |          |    |
| MATH1011                                       | General Mathematics 1B                    | 6        | 0        | 15 |
| MATH1231                                       | Mathematics 1B or                         |          |          |    |
| MATH1241                                       | Higher Mathematics 1B or                  |          |          |    |
| MATH1021                                       | General Mathematics 1C                    | 0        | 6        | 15 |
|  | and an additional 2                       |          |          |    |
|  | level 1 subjects: recommend               | ed       |          |    |
| and either                                     |   |          |          |    |
| BIOS1101                                       | Evolutionary and Functional               |          |          |    |
|  | Biology and                               | 0        | 6        | 15 |
| BIOS1201                                       | Molecules, Cells and Genes of             | r 6      | 0        | 15 |
| GEOL1101                                       | Geological Processes and                  | 6        | 0        | 15 |
| GEOL1201                                       | Geological Environments                   | 0        | 6        | 15 |
| Total HPW Se<br>Total HPW Se<br>Total Credit P | ession 1 22<br>ession 2 24<br>Points 120  |          |          |    |
| GEOG2000                                       | Field Project 2                           | 15       | 15       | 10 |
| GE0G2013                                       | Geographical Data Analysis                | 4        | 0        | 15 |
| GEOG2025                                       | Biogeography                              | ñ        | 4        | 15 |
| GEOG2092                                       | Australian Social and                     | U        | -        | 10 |
|  | Economic Landscapes                       | 4        | ٥        | 15 |
| GEOG3123                                       | Applied Geographic                        | •        | •        |    |
|  | Information Systems                       | 0        | 4        | 15 |
| and either                                     |   | -        |          |    |
| GEOG2051                                       | Soils and Landforms or                    | 4        | 0        | 15 |
| GEOG2061                                       | Regional Theory                           | 4        | Ō        | 15 |
| or two of the fo<br>BIOS2011                   | llowing<br>Evolutionary and Physiologic   | al       |          | _  |
| DIO OGGO                                       | Ecology                                   | 6        | 0        | 15 |
| BIOS2031                                       | Biology of Invertebrates                  | 0        | 6        | 15 |
| BIOS2051                                       | Flowering Plants                          | 6        | 0        | 15 |
| BIOS2061                                       | Vertebrate Zoology                        | 0        | 6        | 15 |
| and for all stud                               | ents                                      | _        | _        |    |
| General Educa                                  | ition subject/s                           | 2        | 2        | 15 |
| Total HPW Se<br>Total HPW Se<br>Total Credit P | ssion 1 19.5<br>ssion 2 19.5<br>oints 130 |          |          |    |

|                  |                                   | HP<br>S1 | W<br>S2 | СР |
|------------------|-----------------------------------|----------|---------|----|
| Year 3           |                                   |          |         |    |
| GEOG2021         | Introduction to Remote            |          |         |    |
|                  | Sensing                           | 0        | 4       | 15 |
| GEOG3000         | Field Project 3                   | 1.5      | 1.5     | 15 |
| GEOG3062         | Environmental Change              | 4        | 0       | 15 |
| GEOG3082         | Project Design and                |          |         |    |
|                  | Formulation                       | 0        | 3       | 10 |
| GEOG3172         | Spatial Population Analysis       | 0        | 4       | 15 |
| plus two of the  | following                         |          | _       |    |
| GEOG3011         | Pedology                          | 4        | 0       | 15 |
| GEOG3025         | Geomorphology                     | 0        | 4       | 15 |
| GEOG3032         | Remote Sensing Application:       | 54       | 0       | 15 |
| GEOG3142         | Geographic Information            |          |         |    |
|                  | Systems Applications              | 0        | 4       | 15 |
| and one of the   | following                         | ~        | ~       | 4- |
| BIOS3061         | Plant Ecosystem Processes         | 6        | 0       | 15 |
| BIOS3071         | Conservation Biology and          | ~        | •       |    |
|                  | Diversity                         | 6        | 0       | 15 |
| GEOL7321         | Geology for Geomorphologists      | <b>`</b> |         | 45 |
| and fan all abu  | and Pedologists                   | 2        | 4       | 15 |
| and for all stud | Jenis                             | 2        | 2       | 15 |
| General Educa    | alion subject/s                   | 2        | 2       | 15 |
| Total HPW Se     | ession 1 15.5/19.5                |          |         |    |
| Total HPW Se     | ession 2 16.5/20.5                |          |         |    |
| Total Credit F   | Points 130                        |          |         |    |
|                  |                                   |          |         |    |
| N                |                                   |          |         |    |
| Year 4           | Estimate antal loga at            |          |         |    |
| GEUG3042         | Environmental impact              | 4        | ^       | 15 |
| 05004010         | Assessment<br>Field Breight 4     | 4        | e<br>e  | 20 |
| GEOG4010         | Project 4                         | 8        | 0       | 20 |
| GEOG4031         | Project<br>Brastical Applications | 0        | 4       | 10 |
| GEOG4042         | Advanced Special Analysist        | 4        | 7       | 15 |
| GEOG4052         | Advanced Environmental            | -        | U       | 15 |
| GE0G4062         | Analysis*                         | 4        | 0       | 15 |
|                  |                                   | -        | U       | .5 |
| Total HPW Se     | ession 1 20                       |          |         |    |
| Total HPW Se     | ession 2 18                       |          |         |    |
| Total Credit F   | Points 115                        |          |         |    |
|                  |                                   | -        |         |    |

\*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.

# 3010.4000 Human and Physical Resources Economic

|                                       |                              | HP<br>S1 | W<br>S2 | СР |
|---------------------------------------|------------------------------|----------|---------|----|
| Year 1 (same)                         | as for 3010.2000)            |          |         |    |
| GEOG1000                              | Field Project 1              | 2        | 2       | 10 |
| GEOG1022                              | Locational Processes         | 0        | 4       | 10 |
| GEOG1022                              | Environmental Processes      | ň        | 4       | 15 |
| CEOG1042                              | Data Processing Systems      | Ă        | ñ       | 10 |
| GEOG1043                              | Data Processing Systems      | Ā        | 4       | 10 |
| GEOG1044                              | Australia and Clabal         | U        | 4       | 10 |
| GEOG1062                              | Australia and Global         |          |         |    |
|                                       | Geographies: Integration     |          | ~       |    |
| · · · · · · · · · · · · · · · · · · · | and Divergence               | 4        | 0       | 15 |
| MATH1131                              | Mathematics 1A or            |          |         |    |
| MATH1141                              | Higher Mathematics 1A or     |          |         |    |
| MATH1011                              | General Mathematics 1B       | 6        | 0       | 15 |
| MATH1231                              | Mathematics 1B or            |          |         |    |
| MATH1241                              | Higher Mathematics 1B or     |          |         |    |
| MATH1021                              | General Mathematics 1C       | 0        | 6       | 15 |
|                                       | and an additional 2          |          |         |    |
|                                       | level 1 subjects: recommend  | ed       |         |    |
| and either                            | ,                            |          |         |    |
| ECON1101                              | Microeconomics 1 and         | 3        | 0       | 15 |
| ECON1102                              | Macroeconomics 1             | Ō        | 3       | 15 |
| or                                    |                              | •        | -       |    |
| ECON1103                              | Microeconomic Principles and | 3        | 0       | 15 |
| ECON1104                              | Macroeconomic Principles     | ň        | ă       | 15 |
|                                       | Macroeconomic 1 melpics      | Ŭ        | Ŭ       |    |
| Total HPW Se                          | ession 1 19                  |          |         |    |
| Total HPW Se                          | ession 2 23                  |          |         |    |
| Total Credit P                        | Points 130                   |          |         |    |
| Year 2                                |                              |          |         |    |
| GEOG2000                              | Field Project 2              | 1.5      | 1.5     | 10 |
| GEOG2013                              | Geographical Data Analysis   | 4        | 0       | 15 |
| GEOG2025                              | Biogeography                 | 0        | 4       | 15 |
| GEOG2052                              | Project in Spatial Analysis  | 0        | 4       | 10 |
| GE0G2061                              | Regional Theory              | 4        | Ó       | 15 |
| GE0G2092                              | Australian Social and        |          | •       |    |
| aloazosz                              | Economic Landscapes          | 4        | 0       | 15 |
| GE0G3123                              | Applied Geographic           | -        | Ŭ       |    |
| 02003120                              | Information Systems          | Δ        | Δ       | 15 |
| FOONIDADD                             | Business and Covernment      | 8        | 2       | 15 |
| ECON2103                              | Business and Government      | U        | 3       | 15 |
| ECON2104                              | Australian Macroeconomic     | ~        | ^       | 4- |
|                                       |                              | 3        | U       | 15 |
| and for all stud                      |                              | ~        | ~       | 4- |
| General Educa                         | ation Subject/s              | 2        | 2       | 15 |
| Total HPW Session 1 18.5              |                              |          |         |    |
| <b>Total HPW Se</b>                   | ession 2 18.5                |          |         |    |
| <b>Total Credit F</b>                 | Points 140                   |          |         |    |

|                                |                                | л<br>S1 | S2  | CP  |
|--------------------------------|--------------------------------|---------|-----|-----|
| Veer 2                         |                                |         |     |     |
| CEOCO001                       | Introduction to Domoto         |         |     |     |
| GE0G2021                       | Sensing                        | ~       |     | 4.5 |
| 0500000                        | Sensing                        | 0       | 4   | 15  |
| GEOG3000                       | Field Project 3                | 15      | 1.5 | 15  |
| GEOG3062                       | Environmental Change           | 4       | 0   | 15  |
| GEOG3082                       | Project Design and             |         |     |     |
|                                | Formulation                    | 0       | 3   | 10  |
| GEOG3172                       | Spatial Population Analysis    | 0       | 4   | 15  |
| and two of the                 | following                      |         |     |     |
| GEOG3011                       | Pedology                       | 4       | 0   | 15  |
| GEOG3025                       | Geomorphology                  | 0       | 4   | 15  |
| GEOG3032                       | Remote Sensing Applications    | s 4     | 0   | 15  |
| GEOG3142                       | Geographic Information         |         |     |     |
|                                | Systems Applications           | 0       | 4   | 15  |
| GEOG3166                       | Place and Politics of Identity | ò       | 4   | 15  |
| and two of the following       |                                |         |     |     |
| ECON2109                       | Economics of Natural           |         |     |     |
|                                | Resources                      | 3       | 0   | 15  |
| ECON2117                       | Economics of Tourism           | 3       | õ   | 15  |
| ECON2127                       | Environmental Resources        | 0       | v   |     |
| LOOKLIE                        | and Cost Benefit Analysis      | Δ       | 3   | 15  |
| and for all stur               | dente                          | U       | 5   | 15  |
| Conorol Education Subject/s    |                                | 0       | 15  |     |
| General Luuc                   | alion Subject/s                | ۷       | 2   | 15  |
| Total HPW Se                   | ession 1 16 5/19 5             |         |     |     |
| Total HPW Session 2, 16 5/10 5 |                                |         |     |     |
| Total Credit B                 | Dointe 1/15.5                  |         |     |     |
| rotal Great P                  | - Unita 140                    |         |     |     |

......

|                         |                            | HF<br>S1 | PW<br>S2 | СР |
|-------------------------|----------------------------|----------|----------|----|
| Year 4                  |                            |          |          |    |
| GEOG3042                | Environmental Impact       |          |          |    |
|                         | Assessment                 | 4        | 0        | 15 |
| GEOG4010                | Field Project 4            | 0        | 6        | 20 |
| GEOG4031                | Project                    | 8        | 8        | 40 |
| GEOG4042                | Practical Applications     | 0        | 4        | 10 |
| GEOG4052                | Advanced Spatial Analysis* | 4        | 0        | 15 |
| GEOG4062                | Advanced Environmental     |          |          |    |
|                         | Analysis*                  | 4        | 0        | 15 |
| Total HPW Session 1 20  |                            |          |          |    |
| Total HPW Session 2 18  |                            |          |          |    |
| Total Credit Points 115 |                            |          |          |    |

\*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.

# **Graduate Study**

A number of coursework Masters degrees and Graduate Diplomas are available through the School of Geography. In addition the School welcomes enquiries from graduates who are interested in research leading to the award of the degrees of Doctor of Philosophy 1080 or Master of Science 2040.

# **Course Outlines**

# Graduate Program in Geographic Information Systems

8047.1000 **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, Geomatic Engineering, or a relevant environmental science.

Course requirements. Candidates are required to complete a course totalling a minimum of 120 credit points made up of 3 compulsory subjects, 3 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    |   |    |
|------------------------|---|----|
| GEOG9240               | Principles of Geographic Information<br>Systems | 12 |
| GEOG9241               | Advanced Geographic Information<br>Systems      | 12 |
| GEOG9512<br>and either | Project   | 48 |
| GEOG9280*              | Applications and Management of GIS              | 12 |
| GMAT9604*              | Land Information Systems                        | 12 |

### Elective subjects

| Fiectine annie |  | <b>-</b> . |
|----------------|--|------------|
| COMP9311       | Introduction to Data Base Systems      | 15         |
| GEOG9150       | Remote Sensing Applications            | 12         |
| GEOG9210       | Computer Mapping and Data Display      | 12         |
| GEOG9242       | Transportation Applications of         |            |
|                | Geographic Information Systems         | 12         |
| GEOG9250       | Special Topic                          | 12         |
| GEOG9290       | Image Analysis in Remote Sensing       |            |
| GMAT9530       | Analytical Photogrammetry              | 12         |
| GMAT9532       | Data Acquisition and Terrain Modelling | 12         |
| GMAT9600       | Principles of Remote Sensing           | 12         |
| KCME1110       | Geographical Information Systems in    |            |
|                | Applied Geology                        | 12         |
|                |  |            |

CP

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

Programs are available leading to the award of:

Master of Applied Science in Rangeland Management 8025 Graduate Diploma in Rangeland Management 5025 See entry under Wool and Pastoral Science

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.

# **Graduate Programs in Remote Sensing**

Programs are available leading to the award of:

Master of Applied Science in Remote Sensing 8047.2000 Graduate Diploma in Remote Sensing 5047.2000

# 8047.2000 Remote Sensing

### 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, geomatic

engineering, or in a relevant environmental, biological or agricultural science.

Course requirements. Candidates are required to complete a course totalling 120 credit points, made up of 3 compulsory subjects, 3 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 S   | Subjects                               | СР  |
|----------------|--|-----|
| GEOG9150       | Remote Sensing Applications            | 12  |
| GEOG9290       | Image Analysis in Remote Sensing       | 12  |
| GMAT9600       | Principles of Remote Sensing           | 12  |
| GMAT9606       | Microwave Remote Sensing               | 12  |
| and either     |  |     |
| GEOG9512       | Project or                             | 48  |
| GEOL0114       | Project                                | 48  |
| Elective subie | cts                                    |     |
| GEOG9042       | Environmental Impact Assessment        | 12  |
| GEOG9210       | Computer Mapping and Data Display      | 12  |
| GEOG9240       | Principles of Geographical Information |     |
|                | Systems                                | 12  |
| GEOG9241       | Advanced Geographical Information      |     |
|                | Systems                                | 12  |
| GEOG9250       | Special Topic                          | 12  |
| GEOG9280       | Applications and Management of GIS     | 12  |
| GEOL0110       | Geological Remote Sensing*             | 12  |
| GEOL0310       | Image Processing of Spatial Data Sets  | 12  |
| GEOL0360       | Remote Sensing Applications in         |     |
|                | Geoscience                             | 12  |
| GMAT9530       | Analytical Photogrammetry              | 12  |
| GMAT9532       | Data Acquisitions and Terrain Modellin | g12 |

\*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.

# 5047.2000 Remote Sensing

### 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 a minimum of 84 credit points made up of 5 compulsory subjects (60 credit points) and 2 elective subjects (24 credit points). 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.

# Compulsory subjects

| Compulsory a    | SUDJECTS                                   | CP   |
|-----------------|--|------|
| GEOG9150        | Remote Sensing Applications                | 12   |
| GEOG9290        | Image Analysis in Remote Sensing           | 12   |
| GMAT9600        | Principles of Remote Sensing               | 12   |
| GMAT9605        | Field Data Collection and Integration      | 12   |
| GMAT9606        | Microwave Remote Sensing                   | 12   |
| Elective subje  | ects                                       |      |
| From the follow | ring (or as approved by the relevant Facul | ty): |
| CIVL9861        | Environmental and Engineering              | •••  |
|                 | Geophysics                                 | 12   |
| CIVL9875        | Hydrological Processes                     | 12   |
| GEOG9160        | Directed Problems in Remote Sensing        | 12   |
| GEOG9210        | Computer Mapping and Data Display          | 12   |
| GEOG9240        | Principles of Geographic Information       |      |
|                 | Systems                                    | 12   |
| GEOL0110        | Remote Sensing in Applied Geology          | 12   |
| GEOL9060        | Environmental Geology                      | 12   |
| GMAT9211        | Introduction to Geodesy                    | 12   |
| GMAT9532        | Data Acquisition and Terrain Modelling     | 12   |
| GMAT9604        | Land Information Systems                   | 12   |

# Graduate Programs in Environmental Studies

# 8045 Environmental Studies

### 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. See entry under Safety Science

# 8047.3000 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 120 credit points made up of 3 compulsory subjects (36 credit points), a project (36 credit points), and 4 elective subjects (48 credit points). 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.

| Compulsory subjects |                                      |    |
|---------------------|--------------------------------------|----|
| GEOG9300            | Vegetation Management                | 12 |
| GEOG9310            | River Management                     | 12 |
| GEOG9320            | Soil Degradation and Conservation    | 12 |
| GEOG9509            | Project                              | 36 |
| Elective subje      | ects*                                |    |
| GEOG9042            | Environmental Impact Assessment      | 12 |
| GEOG9150            | Remote Sensing Applications          | 12 |
| GEOG9240            | Principles of Geographic Information |    |
|                     | Systems                              | 12 |
| GEOG9241            | Advanced Geographic Information      |    |
|                     | Systems                              | 12 |
| GEOG9250            | Special Topic                        | 12 |
| GMAT9600            | Principles of Remote Sensing         | 12 |
| SAFE9273            | Environment and Law                  | 8  |
|                     |                                      |    |

\*Alternative subjects may be substituted with the permission of the Course Coordinator.

# **Subject Descriptions**

Descriptions of all undergraduate and graduate subjects are presented in alphanumeric order within organisational units. Note that due to on-going course changes some subjects offered in Year 2 have 3000 numbers and vice versa. 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: Dr B Parolin and Mr D Edwards CP10 F T2

A five days field project normally undertaken during the mid-year recess, designed to support teaching in Year 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 CP10 S2 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: Mr D Edwards CP15 S2 L3 T1 Note/s: Excluded GEOG1073.

The subject is an introduction to physical geography outlining the processes and history of physical and biological components of the environment. This knowledge is then used to improve our understanding of global environmental problems. Aspects of the environment considered include the Earth's energy balance, atmospheric systems, ecosystems, soils and erosion processes.

## GEOG1043

Data Processing Systems Staff Contact: Mr S Filan CP10 S1 L2 T2

Measurement, management, analysis and display of general and spatial data. Basic use of the University's campus wide network, predominantly with personal computers. Use of software (particularly SPSS for Windows) for management, processing, analysis and display of data.

#### GEOG1044

Data Display Systems Staff Contact: Prof B Garner CP10 S2 L2 T2 Prerequisite: GEOG1043

Graphic information processing. Data display in tables, graphs, diagrams and maps. Thematic mapping. Effective use of colour and shading. Design principles and use of symbolism. Multiple-feature displays. Data entry and digitising. Graphics production, thematic mapping and computer-assisted cartography using appropriate software.

#### GEOG1062

# Australian and Global Geographies: Integration and Divergence

Staff Contact: A/Prof I Burnley, Dr M Sant, Ms B Scott, Mr K. Dunn

CP15 S1 L3 T1 Note/s: Excluded GEOG1064, GENA3001.

The geography of contemporary Australian economy and society. Patterns and consequences of economic and cultural diffusion and change. Integration and divergence at national, regional and local scales. Urbanisation and the evolution of the world city concept Australia's position. The geography of industrialisation and deindustrialisation. The changing structure and flow of population, capital and culture in the Asia-Pacific realm. Emergent social, economic and environmental inequalities. Trends of postindustrialism, new industries, new regimes of production and their geographical consequences. Landscapes of production and consumption. Transformations of gender roles and influences of the women's movement. Changing patterns and impacts of migration. The global diffusion of populate culture and the reaction in Australia. Re-assessments of national identity. Cultural diversity and public policy. Planning for socially and environmentally sustainable cities.

#### GEOG1064

# Global Development, Economy and Environment in Australia

Staff Contact: A/Prof I Burnley, Dr M Sant, Mr K Dunn CP20 S1 L4 T2

Note/s: Students will incur personal costs. Excluded GEOG1062.

Progressive integration of Australia into global capitalism and developmental and environmental consequences of this process in Australia and adjacent territories. Colonial and dependent development in Australia and resource use; applications of recent development theory as applied to core periphery relationships between world financial centres and Australia, and between Australia and adjacent territories; transnational organisations and technology transfer and investment in Australia and relationships amongst changing trade patterns, production and development in Australia. Impacts of specific economic imperatives, population growth and patterns of production and consumption on resources, land degradation and flora and fauna in Australia. Role of political factors and management guality in sustainable development and environmental protection.

#### GEOG1073

Environmental Processes and Analysis Staff Contact: Mr D Edwards CP15 S2 L3 T3 Note/s: Excluded GEOG1031.

This subject has the same content as GEOG1031 but with an additional 2 hour laboratory introducing methods of analysis of climates, soils, hyrology, landforms and vegetation.

## GEOG2000

Field Project 2 Staff Contact: Mr J Sammut (Physical) Dr M Sant (Economic) CP10 F T1.5 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: Mr S Filan CP15 S1 L1 T3 Prerequisite: Either GEC

Prerequisite: Either GEOG1073 or both GEOG1031 and GEOG1062

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 CP15 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.

## GEOG2025

Biogeography Staff Contact: A/Prof M Fox CP15 S2 L2 T2 Prerequisites: GEOG1073 and both BIOS1011 and BIOS1021

Distribution of taxa. Floras of the Southern Hemisphere with particular reference to Australia. Endemic, discontinuous and relict taxa. Dispersal and migration of species. Origin, evolution and geological history of Angiosperms. The development of the Australian biogeographic element. Study of the recent past to understand present distributions of taxa. The role of humans and climatic change on Australian vegetation. Detection of pattern and association and their causes. Classification, ordination and mapping of vegetation. Ecology of selected Australian vegetation types. Management of vegetation in different climate regimes.

#### GEOG2051

Soils and Landforms Staff Contact: Dr W Erskine, Mr J Sammut CP15 S1 L2 T2 Prerequisite: GEOG1031 or GEOG1073

An introduction to soil classification schemes with particular emphasis on the soils and landforms of flood-plains 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.

## GEOG2052

Project in Spatial Analysis Staff Contact: Dr M Sant, Mr K Dunn CP10 S2 L1 T3 Prerequisite: GEOG1022

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 CP15 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 CP15 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, Ms B Scott, Mr K Dunn CP15 S1 L2 T2 Pracequisite: CEOC1050

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.

## GEOG3000

Field Project 3 Staff Contact: A/Prof M Melville (Physical), Prof B Garner (Economic) CP15 F T1.5 Prerequisite: One of GEOG2025, GEOG3011, GEOG3025.

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

CP15 S1 L2 T2 *Prerequisites:* GEOG1073 and one of CHEM1101 or CHEM1401 or both GEOL1101 and GEOL1201 or both BIOS1011 and BIOS1021

Methodology of pedogenic studies and the application of these studies to the understanding of soil and form relationships. Soil physical and chemical properties and their interrelationships, emphasizing clay-mineral 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.

#### GEOG3025

Geomorphology Staff Contact: Dr W Erskine CP15 S2 L2 T2 Prerequisites: GEOG2051

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.

#### GEOG3032

## **Remote Sensing Applications**

Staff Contact: Mr A Evans CP15 S1 L2 T2 Prerequisite: GEOG2021 or GMAT8711

Spectral characteristics of natural phenomena and image formation. Ground truthing, collection and calibration. Introduction to computer classification procedures. Multi-temporal 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.

#### GEOG3041

#### **Mathematical Methods for Spatial Analysis**

Staff Contact: Mr S Filan CP15 S1 L2 T2 Prerequisite: MATH1021 or MATH1032 or MATH1231 or MATH1042 or MATH1241 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; facility location and allocation problems.

### GEOG3042

## **Environmental Impact Assessment**

Staff Contact: Dr W Erskine CP15 S1 L2 T2 Prerequisites: GEOG1031 or GEOG1073 or by permission from Head of School

Rationale and basic objectives; history and legislative framework: standardised 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.

## GEOG3062

## Environmental Change

Staff Contact: School Office CP15 S1 L2 T2 *Prerequisite:* Successful completion of a Year 2 Program in Applied Science, Science, or Arts or equivalent as approved by the Head of School

The nature of environmental change on the land, oceans, biosphere and atmosphere. Evolution of the continents, oceans, life and atmosphere. Techniques for environmental reconstruction and chronology building. Quaternary climatic change and modelling. Human impact on the atmosphere and climatic consequences.

## GEOG3082

Project Design and Formulation Staff Contact: Dr B Parolin CP10 S2 L1 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: Dr B Parolin (Coordinator), A/Prof I Burnley, Mr K Dunn CR10 St L 2 T2

CP10 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 BJ Garner, Mr S Filan

CP15 S2 L2 T2

*Prerequisite:* Successful completion of at least one year of course 2700.0600 Computer Science or course 2700.1400 Information Systems, or by permission from the Head of School.

**Note/s:** Enrolments in this subject are constrained by availability of laboratory facilities. All enrolments must be approved by the Head, School of Geography, or representative.

An introduction to geographic information systems with special reference to computer-based systems for resource evaluation. Case study evaluation, application of the MAP and other GIS software.

### GEOG3123

## Applied Geographic Information Systems

Staff Contact: Prof BJ Garner, Mr S Filan CP15 S2 L2 T2

*Prerequisite:* Successful completion of at least three subjects offered by the School of Geography, or by special permission from the Head of the School of Geography, or representative.

An introduction to information systems of particular relevant 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: School Office CP15 S1 L2 T2 Prerequisite: MARK2042. This prerequisite does not apply to students enrolled in course 3010. Note/s: Not offered in 1997.

Organisation 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 intra-urban 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 CP15 S2 L2 T2 Prerequisite: GEOG3122 or GEOG3123

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.

#### GEOG3161

#### **Computer Mapping and Data Display**

Staff Contact: Prof BJ Garner CP15 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 MapInfo 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.

#### GEOG3166

Place and the Politics of Identity Staff Contact: Mr K Dunn CP15 S2 L2 T2 Prerequisite: GEOG2092

Identity and place and intricately bound up with each other. This subject grapples with issues of place, identity, territory and representation. Case studies cover a range of axes of difference including religion, place, gender, sexuality, nationalism and popular culture. Recent influences on, and orientations of, the sub-discipline of cultural geography are introduced. The key theories of identity are critically discussed. Creative and official representations of places and of peoples are critically analysed. Contemporary political issues associated with the deployment and representation of cultural difference are discussed including both oppressive and emancipatory articulations of identity.

## GEOG3172 Spatial Population Analysis

Staff Contact: A/Prof I Burnley CP15 S2 L2 T2 Prerequisite: GEOG2092

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 minternational scales. The adjustment of immigrant and migrant populations to the urban environment.

## GEOG3181

Urban Activity Systems Staff Contact: Dr B Parolin

CP15 S1 L2 T2 Prerequisite: GEOG2092

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 CP15 S2 L2 T2 Prerequisite: GEOG2092

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, Mr J Sammut CP15 S1 L2 T2 Prerequisite: GEOG1073 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.

#### GEOG3333 Special Topic Staff Contact: A/Prof M Fox CP15 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/Prof I Burnley CP15 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 CP20 S2 T6

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: Dr B Parolin CP40 F T8 Prerequisite: GEOG3082 Note/s: The deadline for submission of project reports is the end of Week 7 of Session 2.

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.

#### GEOG4042

Practical Applications in Geography Staff Contact: Prof BJ Garner CP10 S2 T4

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.

#### GEOG4100/GEOG4050

Honours Geography Staff Contact: Dr B Parolin CP120/60 F

Prerequisites: Arts students must satisfy Faculty requirements for entry to the Honours Level program and must have obtained at least135 credit points in Geography subjects, including 30 Level 1 credit points and must include GEOG2013. A minimum cumulative average at Credit level is required for all Upper Level subjects taken.

Science students must have completed either program 2700, 2527 or 6851 including GEOG2013 and 120 Level III credit points.

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.

#### GEOG4052

## Advanced Spatial Analysis

Staff Contact: Dr B Parolin CP15 S1 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 CP15 S1 L2 T2

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

#### GEOG4300

Vegetation management Staff Contact: A/Prof M Fox

CP15 S1 L2 T2

*Prerequisite:* Completion of Stage 3 of a four-year degree program.

Note/s: Contact hours include some fieldwork which forms a compulsory part of this subject. Students will incur some personal costs for fieldwork.

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.

## GEOG4310

River management Staff Contact: Dr W Erskine

CP15 S2 L2 T2

*Prerequisite:* Completion of Stage 3 of a four-year degree program.

**Note/s:** Contact hours include some fieldwork which forms a compulsory part of this subject. Students will incur some personal costs for fieldwork.

The principles of river management including total or integrated catchment management, environmental impact assessment, in-stream uses and hydrogeomorphic behaviour. Issues covered include regulated rivers, inter-basin 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.

#### GEOG4320

Soil Degradation and Conservation

Staff Contact: A/Prof M Melville and Dr W Erskine CP15 S2 L2 T2

*Prerequisite:* Completion of Stage 3 of a four-year degree program.

**Note/s:** Contact hours include some fieldwork which forms a compulsory part of this subject. Students will incur some personal costs for fieldwork.

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.

#### GEOG9042

#### Environmental Impact Assessment Staff Contact: Prof BJ Garner

CP12 S1 L2 T2

Environmental planning legislation and decision making processes in Australia with special reference to NSW. The content and structure of Environmental Impact Statements and the stages in the granting of development consent. Approaches to EIA with reference to the assessment of impacts on the natural, social and economic environments. Case studies exemplifying procedures, techniques, methods, and issues. Trends in EIA in Australia and selected other countries.

#### GEOG9130

#### Soil Studies for Arid Lands Management

Staff Contact: A/Prof M Melville CP12 S1 L2 T1

Soil forming processes in arid regions. Physical, mineralogical and chemical characteristics of arid soils, with emphasis on properties significant for land capability. Chemical and physical properties of saline and alkaline soils. Soil response to irrigation, secondary salinisation and alkalinisation. 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.

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: Mr A Evans CP12 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; multi-temporal 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: Mr A Evans

CP12 S2 T3

A detailed investigation of a particular aspect of remote sensing technology or an area of applications relevant to candidates interests and background.

#### GEOG9210

#### Computer Mapping and Data Display Staff Contact: Prof B Garner CP12 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. MapInfo is used for cartographic manipulation and output.

#### GEOG9230

Population, Health and Environment Staff Contact: A/Prof I Burnley CP12 S2 L2

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

CP12 S1 L1 T2

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: School Office CP12 S2 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.

#### GEOG9242

#### Transportation Applications of Geographical Information Systems Staff Contact: Dr B Parolin CP12 S2 L1 T2

Prerequisite: GEOG9240

This subject provides an overview and hands-on experience in the design, use, and interpretation of Transport Information Systems (GIS-T's). Topics covered include transportation layers, transportation related referencing systems, data structures, network structures, urban transportation planning models, logit and other spatial models. At the end of the subject, the student will have a sound working knowledge of transportation GIS and an ability to work directly with real problems in government and private sectors.

### GEOG9250

Special Topic Staff Contact: Prof B Garner CP12 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: Prof B Garner, Dr Q Zhou CP12 S1 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), human activities at the local, national and global scale will be critically reviewed. The course will involve the practical use of project management tools.

#### GEOG9290

#### Image Analysis of Remote Sensing Staff Contact: Mr A Evans CP12 S2 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 M Fox

CP12 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 Erskine

CP12 S2 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, in-stream uses and hydrogeomorphic behaviour. Issues covered include regulated rivers, inter-basin 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. Dr W Erskine

CP12 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 CP12 S1 L1 T2 Note/s: Not offered in 1997.

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: A/Prof M Melville CP36 S2 T9

A practical application or investigation in environmental studies or in land classification as a basis for land management or land use 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: Prof B Garner, Dr Q Zhou CP48

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. 108 APPLIED SCIENCE

# School of Materials Science and Engineering

Head of School Professor DJ Young

## Administrative Assistant

Mr OS Andersen

The field of Materials Science and Engineering offers unlimited possibilities for innovation and development. Attention is being focussed on developing and processing metals, ceramics, polymers and composites with improved properties.

The activities of the materials engineer range from materials production, including their extraction from ores and their refining, to the design, development, processing and recycling of materials for use in aerospace, transportation, electronics, energy conversion, and biomedical systems.

Advanced materials can provide a major competitive advantage in virtually every part of a country's manufacturing industry. Because Australia is a country rich in minerals, materials science has been designated as a priority area for research and development. Examples of recent and significant developments include the emergence of environmentally friendly and economical metal processing methods; advanced surface coatings; electrical ceramics; engineering polymers, and advanced composites.

The School of Materials Science and Engineering provides education and training for students to prepare them for a significant and important career in the materials industry.

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 specialisation 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.

# **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. This 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 go initially into activities associated directly with production, i.e. the design and layout of plants, supervision of their construction and control of their operations. Others move into research and development in industrial laboratories or research institutions. The final group enters fields outside of Ceramic Engineering directly, where the graduate's background in materials and engineering is utilised. In all cases, graduates with organising ability frequently move into management if they have an interest in this side of the industry.

In Australia, a number of government research organisations are active in ceramic research, e.g. the Australian Nuclear Science and Technology Organisation, and the Divisions of Materials Science and Building Research of the CSIRO. Investigations with more immediate applications are carried out in industrial laboratories. Even when the basic principles of a process have been worked out in the laboratory, its successful transfer to an industrial scale requires a great deal of effort and expertise. This is an area which offers great scope for further development in Australia.

Graduates in Ceramic Engineering are eligible for membership of the Institution of Engineers, Australia, the Institute of Ceramics, Great Britain, the Royal Australian Chemical Institute and the National Institute of Ceramic Engineers, USA

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

# Metallurgical Engineering

The metallurgical profession has developed in importance in keeping with growth of Australian metal and mineral industries. These industries are recognised as being important to the Australian economy and there is a strong demand for professional metallurgists in all sectors of these industries, as well as in the manufacturing industry.

Graduate metallurgists have a wide choice of type of employment and location. They may work in production, technical control or development, in metal or mineral producing plants in locations such as Newcastle, Port Kembla, Broken Hill, Mt Isa, Townsville, Gladstone, Port Pirie, Whyalla, Kwinana, Kalgoorlie or Pilbara; or in manufacturing plants, including the automobile, aircraft, and construction industries located mainly in the population centres.

In the metal industry, opportunities for a career in management are excellent, since it is a tradition in this industry that management should be in the hands of technical people. If graduates are inclined towards research and development, they will find considerable scope in various government, university, and industrial research laboratories.

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 twelve weeks of approved industrial experience before graduation. Industrial experience is usually obtained during the long recess periods.

# **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.

Materials Engineering 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 man-made 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 and state 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.

# Undergraduate Study

## **Course Outlines**

| Ceramic Engineering and Cer  | rami                     | ics                     | <u> </u>                |  |   | HP<br>S1                   | W<br>S2                         | СР   |
|--|--------------------------|-------------------------|-------------------------|--|---|----------------------------|---------------------------------|--|
| A four-year full-time course in Ceramic Engito the award of the BE degree, and a six course in Ceramics leading to the award of degree, are offered within the School. | neerir<br>-year<br>the B | ng lea<br>part<br>Sc (T | ading<br>-time<br>Гech) | Year 2<br>CHEM2818<br>MATH2021<br>MATS1002<br>MATS1022<br>MATS1032<br>MATS1042<br>MATS1052 | Physical Chemistry<br>Mathematics<br>Microstructural Analysis<br>Materials Process Principles<br>Materials Engineering 1A<br>Crystallography and X-Ray<br>Diffraction<br>Materials Engineering 1B | 5<br>2<br>0<br>0<br>2<br>3 | 0<br>2<br>3<br>1<br>3<br>2<br>0 | 12.5<br>15<br>7.5<br>2.5<br>7.5<br>10<br>7.5 |
| 3025<br>Ceramic Engineering Full-time Course   |                          |                         |                         | MATS1062<br>MATS1072<br>MATS1082   | Mechanical Properties of<br>Materials<br>Physics of Materials<br>Thermodynamics of  | 4<br>3                     | 0<br>0                          | 10<br>7.5                                    |
| Bachelor of Engineering<br>BE  |                          |                         |                         | MATS1092<br>MATS1102<br>MATS1112<br>General Educ   | Materials 1<br>Materials and Design 1<br>Numerical Methods<br>Phase Equilibria<br>ation subject/s   | 0<br>0<br>1<br>0<br>2      | 3<br>2<br>2<br>2<br>2<br>2      | 7.5<br>5<br>7.5<br>5<br>15                   |
|  | HF<br>S1                 | PW<br>S2                | СР                      | Total HPW S<br>Total HPW S<br>Total Credit   | ession 1 22<br>ession 2 22<br>Points 120  |                            |                                 |  |
| Year 1<br>CHEM1101 Chemistry 1A<br>CHEM1201 Chemistry 1B   | 6<br>0                   | 0<br>6                  | 15<br>15                | <b>Year 3</b><br>FUEL0040  | Fuel Engineering for Cerami<br>Engineers  | с<br>1                     | 1                               | 5  |
| MATH1131 Mathematics 1A or<br>MATH1141 Higher Mathematics 1A<br>MATH1231 Mathematics 1B or   | 6                        | 0                       | 15                      |  | Instrumentation and Process<br>Control 1<br>Applied Statistics SC   | ;<br>0<br>2                | 3                               | 7.5  |
| MATH1241 Higher Mathematics 1B<br>MATS1001 Introduction to Materials   | 0                        | 6                       | 15<br>5                 | MATS1093   | Thermodynamics of<br>Materials 2  | 2                          | 0                               | 5  |
| MATS1011 Introduction to Materials<br>Engineering  | 1                        | 0                       | 2.5                     | MATS1113<br>MATS1243<br>MATS1163   | Ceramic Process Principles 1<br>Management 1<br>Chemistry of the Solid State  | 2<br>3<br>0                | 0<br>0<br>2                     | 5<br>7.5<br>5                                |
| MATS1021 Introduction to Computing<br>MECH0130 Engineering Drawing and<br>Descriptive Geometry   | 0<br>4                   | 2<br>0                  | 5<br>10                 | MATS2123<br>MATS2133   | Ceramic Process Principles 2<br>Ceramic Raw Materials   | 2 0<br>2                   | 2<br>0                          | 5<br>5                                       |
| MECH0440 Engineering Statics<br>PHYS1002 Physics 1   | 0<br>6                   | 3<br>6                  | 7.5<br>30               | MATS2143<br>MATS2153   | Ceramic Equipment<br>Ceramic Processing<br>Laboratory   | 0<br>0                     | 2<br>4                          | 5<br>10                                      |
| Total HPW Session 123Total HPW Session 225Total Credit Points120   |                          |                         |                         | MATS2183<br>MATS2203   | Refractories<br>Physico Chemical Ceramics<br>Laboratory   | 0<br>4                     | 2<br>0                          | 5<br>10                                      |

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.

|  |  | HF<br>S1 | PW<br>S2 | СР      |
|--|--|----------|----------|---------|
| MATS2213<br>MATS2273   | Diffusion<br>Chemistry of Ceramic              | 2        | 0        | 5       |
|  | Processes                                      | 2        | 0        | 5       |
| General Educa  | Mineral Process Engineering<br>ation subject/s | 2<br>0   | 0<br>4   | 8<br>15 |
| Total HPW Session 122Total HPW Session 220Total Credit Points113 |  |          |          |         |
| Year 4   |  |          |          |         |
| APSE0002   | Social Issues in Applied<br>Science            | 2        | 0        | 5       |
| CEIC4010   | Process Economics 1                            | 1        | õ        | 2.5     |
| CEIC4070   | Laboratory Automation for                      | •        | •        |         |
|  | Ceramic Engineers                              | 2        | 0        | 5       |
| MATS1244   | Management 2                                   | ō        | 4        | 10      |
| MATS1254   | Design Project                                 | ĩ        | 3        | 10      |
| MATS1294   | Electrical Ceramics                            | 2        | õ        | 5       |
| MATS1464   | Materials Seminar                              | 1        | 1        | 5       |
| MATS1534   | Design with Brittle Materials                  | 3        | Ó        | 7.5     |
| MATS2254   | Ceramic Engineering Design                     | 0        | 2        | 5       |
| MATS2264   | Sintering of Ceramics                          | 2        | 0        | 5       |
| MATS2284   | Thermal Properties of                          |          |          |         |
|  | Ceramics                                       | 0        | 2        | 5       |
| MATS3524   | Project (Ceramic Engineering)                  | 3        | 9        | 30      |
| MATS4333   | Fracture Mechanics                             | 2        | 0        | 5       |
| Total HPW Session 119Total HPW Session 221Total Credit Points100 |  |          |          |         |

# 3030

# **Ceramic Engineering Part-time Course**

## Bachelor of Science Technology BScTech

| Stage 1      |                           |   |   |     |
|--------------|---------------------------|---|---|-----|
| MATH1131     | Mathematics 1A or         |   |   |     |
| MATH1141     | Higher Mathematics 1A     | 6 | 0 | 15  |
| MATH1231     | Mathematics 1B or         |   |   |     |
| MATH1241     | Higher Mathematics 1B     | 0 | 6 | 15  |
| PHYS1002     | Physics 1                 | 6 | 6 | 30  |
| Total HPW S  | ession 1 12               |   |   |     |
| Total HPW S  | ession 2 12               |   |   |     |
| Total Credit | Points 60                 |   |   |     |
|              |                           |   |   |     |
| Stage 2      |                           |   |   |     |
| CHEM1101     | Chemistry 1A              | 6 | 0 | 15  |
| CHEM1201     | Chemistry 1B              | 0 | 6 | 15  |
| MATS1001     | Introduction to Materials |   |   |     |
|              | Industry                  | 0 | 2 | 5   |
| MATS1011     | Introduction to Materials |   |   |     |
|              | Engineering               | 0 | 1 | 2.5 |
| MATS1021     | Introduction to Computing | 0 | 2 | 5   |
| MECH0130     | Engineering Drawing and   |   |   | -   |
|              | Description Geometry      | 4 | 0 | 10  |
| MECH0440     | Engineering Statics       | 0 | 3 | 7.5 |
| Total HPW Se | ession 1 10               |   |   |     |
| Total HPW Se | ession 2 14               |   |   |     |
| Total Credit | Points 60                 |   |   |     |

|  |   | H   | PW        | СР      |
|--|---|-----|-----------|---------|
| _                                      |   | S1  | <b>S2</b> |         |
| Stage 3                                | Physical Chamistry                          | -   | ~         | 40 5    |
| MATH2021                               | Mathematics                                 | 2   | 2         | 12.5    |
| MATS1072                               | Physics of Materials                        | 3   | ō         | 7.5     |
| MATS1082                               | Thermodynamics of                           |     |           |         |
|  | Materials 1                                 | 0   | 3         | 7.5     |
| MATS1092                               | Materials and Design 1                      | 0   | 2         | 5       |
| General Educ                           | ation subject/s                             | 0   | 2         | 75      |
| T                                      |   | Ŭ   | -         | 7.5     |
| Total HPW S                            | ession 1 11                                 |     |           |         |
| Total Credit                           | Points 60                                   |     |           |         |
|  |   |     |           |         |
| Stage 4                                |   |     |           |         |
| MATS1002                               | Microstructural Analysis                    | 0   | 3         | 7.5     |
| MATS1022                               | Materials Processes<br>Principles           | ^   | 4         | 25      |
| MATS1032                               | Materials Engineering 1A                    | ő   | 3         | 2.3     |
| MATS1042                               | Crystallography and X-ray                   | Ŭ   | Ũ         |         |
|  | Diffraction                                 | 2   | 2         | 10      |
| MATS1052                               | Materials Engineering 1B                    | 3   | 0         | 7.5     |
| MA151062                               | Mechanical Properties of                    |     | •         | 10      |
| MATS1112                               | Phase Equilibria                            | 4   | 2         | 10      |
| General Educ                           | ation subject/s                             | 2   | ō         | 7.5     |
| Total HPW S                            | ession 1 11                                 |     |           |         |
| Total HPW Se                           | ession 2 11                                 |     |           |         |
| Total Credit F                         | Points 57.5                                 |     |           |         |
| _                                      |   |     |           |         |
| Stage 5                                |   |     |           |         |
| FUEL0040                               | Fuel Engineering for Ceramic                | C . |           | F       |
| MATH2869                               | Applied Statistics SC                       | 2   | ò         | 5       |
| MATS1113                               | Ceramic Process Principles 1                | 2   | Ō         | 5       |
| MATS2123                               | Ceramic Process Principles 2                | 0   | 2         | 5       |
| MATS2133<br>MATS2143                   | Ceramic Raw Materials                       | 2   | 0         | 5       |
| MATS2153                               | Ceramic Processing                          | 0   | 2         | 5       |
|  | Laboratory                                  | 0   | 4         | 10      |
| MATS2203                               | Physico Chemical Ceramics                   |     |           |         |
|  | Laboratory                                  | 4   | 0         | 10      |
| Total HPW Se                           | ession 1 11                                 |     |           |         |
| Total HPW Se                           | ession 2 9                                  |     |           |         |
| Total Credit P                         | oints 50                                    |     |           |         |
| Stage 6                                |   |     |           |         |
| INDC3070                               | Instrumentation and Process                 |     |           |         |
|  | Control 1                                   | 0   | 3         | 7.5     |
| MATS1093                               | Thermodynamics of                           | •   |           | _       |
| MATS1163                               | Materials 2<br>Chemistry of the Solid State | 2   | 0         | 5       |
| MATS1243                               | Management 1                                | 3   | 0         | 7.5     |
| MATS2183                               | Refractories                                | õ   | 2         | 5       |
| MATS2213                               | Diffusion                                   | 2   | 0         | 5       |
| MATS2273                               | Chemistry of Ceramic                        | _   | _         | _       |
| MINE7341                               | Processes<br>Mineral Process Engineering    | 2   | 0         | 5       |
| General Educa                          | ition subject/s                             | 2   | 4         | о<br>15 |
| Tatal UDivi C                          |   | •   | Ŧ         |         |
| Total HPW Se                           | ssion 1 11                                  |     |           |         |
| Total Credit P                         | oints 63                                    |     |           |         |
| ······································ |   |     |           |         |

# **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.

## 3125 Metallurgical Engineering Full-time Course

## Bachelor of Metallurgical Engineering BMetE

Students entering the Bachelor of 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 twelve 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 course, visits are made to various metallurgical works, and students are required to submit reports on some of these.

Students may complete the first one or two years of their degree at their local university engineering school, and then transfer with advanced standing to UNSW.

|                    |                           | <b>S1</b> | S2 |     |
|--------------------|---------------------------|-----------|----|-----|
| Year 1             |                           |           |    |     |
| CHEM1101           | Chemistry 1A              | 6         | 0  | 15  |
| CHEM1201           | Chemistry 1B              | 0         | 6  | 15  |
| MATH1131           | Mathematics 1A or         |           |    |     |
| MATH1141           | Higher Mathematics 1A     | 6         | 0  | 15  |
| MATH1231           | Mathematics 1B or         |           |    |     |
| MATH1241           | Higher Mathematics 1B     | 0         | 6  | 15  |
| MATS1001           | Introduction to Materials |           |    |     |
|                    | Industry                  | 0         | 2  | 5   |
| MATS1011           | Introduction to Materials |           |    |     |
|                    | Engineering               | 1         | 0  | 2.5 |
| MATS1021           | Introduction to Computing | 0         | 2  | 5   |
| MECH0440           | Engineering Statics       | 0         | 3  | 7.5 |
| MECH0130           | Engineering Drawing and   |           |    |     |
|                    | Descriptive Geometry      | 4         | 0  | 10  |
| PHYS1002           | Physics 1                 | 6         | 6  | 30  |
| Total HPW S        | ession 1 23               |           |    |     |
| <b>Total HPW S</b> | ession 2 25               |           |    |     |
| Total Credit       | Points 120                |           |    |     |

## Year 2

MATS4513

MATS4523

|                |                               | - | - |      |
|----------------|-------------------------------|---|---|------|
| CHEM2818       | Physical Chemistry            | 5 | 0 | 12.5 |
| MATH2021       | Mathematics                   | 2 | 2 | 15   |
| MATS1002       | Microstructural Analysis      | 0 | 3 | 7.5  |
| MATS1022       | Materials Process Principles  | 0 | 1 | 2.5  |
| MATS1032       | Materials Engineering 1A      | 0 | 3 | 7.5  |
| MATS1042       | Crystallography and X-ray     |   | _ |      |
|                | Diffraction                   | 2 | 2 | 10   |
| MATS1052       | Materials Engineering 1B      | 3 | 0 | 7.5  |
| MATS1062       | Mechanical Properties of      |   |   |      |
|                | Materials                     | 4 | 0 | 10   |
| MATS1072       | Physics of Materials          | 3 | 0 | 7.5  |
| MATS1082       | Thermodynamics of             |   |   |      |
|                | Materials 1                   | 0 | 3 | 7.5  |
| MATS1092       | Materials and Design 1        | 0 | 2 | 5    |
| MATS1102       | Numerical Methods             | 1 | 2 | 7.5  |
| MATS1112       | Phase Equilibria              | 0 | 2 | 5    |
| General Educa  | ation subject/s               | 2 | 2 | 15   |
| Total HPW Se   | ession 1 22                   |   |   |      |
| Total HPW Se   | ession 2 22                   |   |   |      |
| Total Credit F | Points 120                    |   |   |      |
| Year 3 (Physi  | cal Metallurgy Major)         |   |   |      |
| MATH2869       | Applied Statistics SC         | 2 | 0 | 5    |
| MATS1093       | Thermodynamics of             |   |   |      |
|                | Materials 2                   | 2 | 0 | 5    |
| MATS1183       | Non-Ferrous Physical          |   |   |      |
|                | Metallurgy                    | 2 | 0 | 5    |
| MATS1203       | Materials and Design 2        | 2 | 2 | 10   |
| MATS1243       | Management 1                  | 3 | 0 | 7.5  |
| MATS1273       | Ferrous Physical Metallurgy A | 0 | 4 | 10   |
| MATS2213       | Diffusion                     | 2 | 0 | 5    |
| MATS2223       | Phase Transformations         | 0 | З | 7.5  |
| MATS4333       | Fracture Mechanics            | 2 | 0 | 5    |

Deformation of Metals Strengthening Mechanisms in

Metals

2 0

Ω

2

5

5

HPW CP

|  |   | H<br>S1          | PW<br>S2              | СР                         |
|--|---|------------------|-----------------------|----------------------------|
| MATS4533<br>MATS4543<br>MATS4553<br>MATS9650<br>General Educ | Metal Forming<br>Fractrographic Analysis<br>Non-Destructive Testing<br>Pyrometallurgical Processes<br>ation subject/s | 2<br>0<br>0<br>0 | 0<br>3<br>1<br>2<br>4 | 5<br>7.5<br>2.5<br>5<br>15 |
| Total HPW S<br>Total HPW S<br>Total Credit I                 | ession 1 19<br>ession 2 21<br>Points 105  |                  |                       |                            |
| Year 4 (Phys<br>APSE0002                                     | ical Metallurgy Major)<br>Social Issues in Applied  | _                |                       | _                          |
| MATS1214   | Science<br>Welding and other Joining<br>Processes   | 2                | 0                     | 5                          |
| MATS1224   | Materials Characterisation  | 1                | 0                     | 5<br>2.5                   |
| MA151234   | Heat Hesisting Alloys   | 1                | 0                     | 2.5                        |
| MATS1244   | Management 2  | 0                | 4                     | 10                         |
| MATS1254   | Design Project  | 1                | 3                     | 10                         |
| MATS1204   | Composites<br>Metal and Ceramic Matrix  | 1                | 0                     | 2.5                        |
| 10/10/2/4  | Composites  | 0                | 1                     | 2.5                        |
| MATS1284   | Light Allovs  | ñ                | i                     | 2.5                        |
| MATS1464   | Materials Seminar   | 1                | i                     | 2.5                        |
| MATS3524   | Project   |                  |                       | 5                          |
| MATS4154   | (Metallurgical Engineering)<br>Mechanical and Thermal   | 3                | 9                     | 30                         |
| Professional E   | Electives*  | 1<br>8           | 0                     | 2.5<br>15                  |
| Total HPW Se<br>Total HPW Se<br>Total Credit F               | ession 1 21<br>ession 2 19<br>Points 95   |                  |                       |                            |
| Vaar 2 (Broos  | no Motoliurau Moior)  |                  |                       |                            |
| FUELOOSO   |   |                  | ~                     |                            |
| INDC3070   | Instrumentation and Process   | 1                | 2                     | 7.5                        |
| MATHOREO   | Applied Statistics CC   | 0                | 3                     | 7.5                        |
| MATE1042   | Applied Statistics SC   | 2                | υ                     | 5                          |
| MATS1043   | Materials Processing  | 2                | 0                     | 5                          |
| MA101095   | Materials 2   | 2                | 0                     | 5                          |
| MATS1183   | Non-Ferrous Physical<br>Metallurov  | 2                | 0                     | 5                          |
| MATS1203   | Materials and Design 2<br>(Unit 1Design for Corrosion   | -                | Ũ                     | Ū                          |
|  | Control)<br>(Unit 2 Surface Treatment   | 2                | 0                     | 5                          |
|  | and Wear)   | 0                | 2                     | 5                          |
| MATS1243   | Management 1  | 3                | 0                     | 7.5                        |
| MATS1283   | Ferrous Physical Metallurgy B   | 0                | 3                     | 7.5                        |
| MATS2183   | Refractories  | 0                | 2                     | 5                          |
| MATS5213   | Metallurgical Plant Practice  | 0                | 1                     | 2.5                        |
| MATS5263   | Extractive Metallurov   | 3                | 4                     | 17.5                       |
| MATS5314   | Kinetics and Mass Transfer in   | -                | ·                     |                            |
|  | Metallurgical Processes   | 1                | 3                     | 10                         |
| MINE7341   | Mineral Process Engineering   | 2                | ň                     |                            |
| General Educa  | ition subject/s   | 2                | 2                     | 15                         |
| Total HPW So   | esion 1 22  | -                | £.                    | 10                         |

| Total HPW Session 1 | 22  |
|---------------------|-----|
| Total HPW Session 2 | 22  |
| Total Credit Points | 118 |

|                |                               | HF<br>S1 | PW<br>S2 | СР  |
|----------------|-------------------------------|----------|----------|-----|
| Year 4 (Proc   | ess Metallurgy Major)         |          |          |     |
| APSE0002       | Social Issues in Applied      |          |          |     |
|                | Science                       | 2        | 0        | 5   |
| MATS1214       | Welding and other Joining     |          |          |     |
|                | Processes                     | 2        | 0        | 5   |
| MATS1244       | Management 2                  | Ō        | 4        | 10  |
| MATS1254       | Design Project                | 1        | 3        | 10  |
| MATS1464       | Materials Seminar             | 1        | 1        | 5   |
| MATS3524       | Project                       |          |          | -   |
|                | (Metallurgical Engineering)   | 3        | 9        | 30  |
| MATS4553       | Non-Destructive Testing       | ō        | 1        | 2.5 |
| MATS5253       | Metallurgical Reaction        | •        | •        |     |
|                | Engineering                   | 2        | 0        | 5   |
| MATS5324       | Modelling Metallurgical       | -        | •        | ÷   |
|                | Processes                     | 4        | 0        | 10  |
| MATS5384       | Air pollution Control         | •        | •        |     |
|                | in the Metallurgical Industry | 1        | 0        | 25  |
| Professional E | Electives*                    | 4        | 2        | 15  |
|                |                               |          | -        |     |
| Total HPW Se   | ession 1 20                   |          |          |     |
| Total HPW Se   | ession 2 20                   |          |          |     |
| Total Credit   | Points 100                    |          |          |     |
|                |                               |          |          |     |

\*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 day-time classes, and one day or more 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.

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.

|  |  | HP<br>S1         | W<br>S2          | СР                     |  |  |
|--|--|------------------|------------------|------------------------|--|--|
| Stage 1<br>MATH1131<br>MATH1141  | Mathematics 1A <i>or</i><br>Higher Mathematics 1A<br>Mathematics 1B or                     | 6                | 0                | 15                     |  |  |
| MATH1231<br>MATH1241<br>PHYS1002   | Higher Mathematics 1B<br>Physics 1   | 0<br>6           | 6<br>6           | 15<br>30               |  |  |
| Total HPW Se<br>Total HPW Se<br>Total Credit F   | ession 1 12<br>ession 2 12<br>Points 60  |                  |                  |                        |  |  |
| Stage 2<br>CHEM1101<br>CHEM1201  | Chemistry 1A<br>Chemistry 1B   | 6<br>0           | 0<br>6           | 15<br>15               |  |  |
| MATS1001   | Introduction to Materials<br>Industry  | 0                | 2                | 5                      |  |  |
| MATS1021<br>MECH0440<br>MECH0130   | Engineering<br>Introduction to Computing<br>Engineering Statics<br>Engineering Drawing and | 1<br>0<br>0      | 0<br>2<br>3      | 2.5<br>5<br>7.5        |  |  |
| Description Geometry401Total HPW Session 111Total HPW Session 213Total Credit Points60 |  |                  |                  |                        |  |  |
| Stage 3<br>CHEM2818<br>MATH2021<br>MATS1072<br>MATS1082                                | Physical Chemistry<br>Mathematics<br>Physics of Materials<br>Thermodynamics of             | 5<br>2<br>3      | 0<br>2<br>0      | 12.5<br>15<br>7.5      |  |  |
| MATS1092<br>MATS1102<br>General Educ   | Materials 1<br>Materials and Design 1<br>Numerical Methods<br>ation subject/s              | 0<br>0<br>1<br>0 | 3<br>2<br>2<br>2 | 7.5<br>5<br>7.5<br>7.5 |  |  |
| Total HPW So<br>Total HPW So<br>Total Credit F   | ession 1 11<br>ession 2 11<br>Points 62.5  |                  |                  |                        |  |  |
| <b>Stage 4</b><br>MATS1002<br>MATS1022<br>MATS1032                                     | Microstructural Analysis<br>Materials Process Principles<br>Materials Engineering 1A       | 0<br>0<br>0      | 3<br>1<br>3      | 7.5<br>2.5<br>7.5      |  |  |
| MATS1042<br>MATS1052   | Crystallography and X-ray<br>Diffraction<br>Materials Engineering 1B                       | 2<br>3           | 2<br>0           | 10<br>7.5              |  |  |
| MATS1062   | Mechanical Properties of<br>Materials<br>Phase Equilibria                                  | 4<br>0           | 0                | 10<br>5                |  |  |
| General Educ   | ation subject/s  | 2                | ō                | 7.5                    |  |  |
| Total HPW Session 2 11<br>Total Credit Points 57.5                                     |  |                  |                  |                        |  |  |

|  |   | HF        | W  | СР  |  |
|--|---|-----------|----|-----|--|
|  |   | <b>S1</b> | S2 |     |  |
| Stage 5  |   |           |    |     |  |
| MATS1183                                       | Non-Ferrous Physical                      |           |    |     |  |
|  | Metallurgy                                | 2         | 0  | 5   |  |
| MATS1273                                       | Ferrous Physical Metallurgy A             | 0         | 4  | 10  |  |
| MATS2213                                       | Diffusion                                 | 2         | 0  | 5   |  |
| MATS2223                                       | Phase Transformations                     | 0         | 3  | 7.5 |  |
| MATS4513                                       | Deformation of Metals                     | 2         | 0  | 5   |  |
| MATS4523                                       | Strengthening Mechanisms                  | 0         | 2  | 5   |  |
| MATS4533                                       | Metal Forming                             | 2         | 0  | 5   |  |
| MATS4543                                       | Fractographic Analysis                    | 0         | 3  | 7.5 |  |
| General Educa                                  | ation subject/s                           | 2         | 0  | 7.5 |  |
| Total HPW Se<br>Total HPW Se<br>Total Credit P | ession 1 10<br>ession 2 12<br>Points 57.5 |           |    |     |  |
| Stage 6  |   |           |    |     |  |
| MATS1164                                       | Welding Science and                       |           |    |     |  |
|  | Technology                                | 0         | 3  | 7.5 |  |
| MATS1203                                       | Materials and Design 2                    | 2         | 2  | 10  |  |
| MATS1464                                       | Materials Seminar                         | 1         | 1  | 5   |  |
| MATS4144                                       | Mechanical and Thermal                    |           |    |     |  |
|  | Processing of Materials                   | 0         | 2  | 5   |  |
| MATS4204                                       | Industrial Metallurgy Project             | 3         | 3  | 15  |  |
| General Educa                                  | ation subject/s                           | 2         | 0  | 7.5 |  |
| Total HPW Session 1 9                          |   |           |    |     |  |
| Total HPW Se                                   | ession 2 12                               |           |    |     |  |
| Total Credit F                                 | Points 55                                 |           |    |     |  |

# **Materials Engineering**

A four-year full-time course in materials engineering leading to the award of the BMatE degree is offered within the School.

## 3615

## Materials Engineering Full-time Course

Bachelor of Materials Engineering BMatE

|                               | HF<br>S1   | W<br>S2  | СР  |
|-------------------------------|--|--|---|
|                               |  |  |   |
| Chemistry 1A                  | 6  | 0  | 15  |
| Chemistry 1B                  | 0  | 6  | 15  |
| Mathematics 1A or             |  |  |   |
| Higher Mathematics 1A         | 6  | 0  | 15  |
| Mathematics 1B or             |  |  |   |
| Higher Mathematics 1B         | 0  | 6  | 15  |
| Introduction to the Materials |  |  |   |
| Industry                      | 0  | 2  | 5   |
| Introduction to Materials     |  |  |   |
| Engineering                   | 1  | 0  | 2.5   |
| Introduction to Computing     | 0  | 2  | 5   |
|                               | Chemistry 1A<br>Chemistry 1B<br>Mathematics 1A or<br>Higher Mathematics 1A<br>Mathematics 1B or<br>Higher Mathematics 1B<br>Introduction to the Materials<br>Industry<br>Introduction to Materials<br>Engineering<br>Introduction to Computing | HF<br>S1<br>Chemistry 1A 6<br>Chemistry 1B 0<br>Mathematics 1A or<br>Higher Mathematics 1A 6<br>Mathematics 1B or<br>Higher Mathematics 1B 0<br>Introduction to the Materials<br>Industry 0<br>Introduction to Materials<br>Engineering 1<br>Introduction to Computing 0 | HPW<br>S1S2Chemistry 1A6O0Chemistry 1B0Mathematics 1A orHigher Mathematics 1A6Mathematics 1B orHigher Mathematics 1B0Higher Mathematics 1B0Introduction to the MaterialsIndustry0Industry0Introduction to MaterialsEngineering1Introduction to Computing0 |

|                        |                    |                       | HF | W  | СР       |                  |                           |                 |                       | HF       | w     | СР     |
|------------------------|--------------------|-----------------------|----|----|----------|------------------|---------------------------|-----------------|-----------------------|----------|-------|--------|
| MECHO130               | Engineering [      | rawing and            | 31 | 52 |          | Voor 4           |                           |                 |                       | 31       | 32    |        |
| WEON0100               | Descriptive G      | eometry               | 4  | 0  | 10       | APSE0002         | s                         | ocial Issue     | s in Applied          |          |       |        |
| MECH0440               | Engineering S      | itatics               | 0  | 3  | 7.5      |                  | S                         | cience          | ••                    | 2        | 0     | 5      |
| PHYS1002               | Physics 1          |                       | 6  | 6  | 30       | MATS1183         | N                         | on-Ferrou       | s Physical            | <u>^</u> | ^     | E      |
| Total HPW Session 1 23 |                    |                       |    |    | MATS1214 | W N              | letailurgy<br>/elding and | d other Joining | 2                     | 0        | Э     |        |
| Total HPW Se           | ession 2<br>Pointe | 25<br>120             |    |    |          |                  | P                         | rocesses        | s enter senting       | 2        | 0     | 5      |
| Total Orealt I         | onna               | 120                   |    |    |          | MATS1244         | M                         | lanagemei       | nt 2                  | 0        | 4     | 10     |
| Year 2                 |                    | · .                   | _  | ~  |          | MATS1254         | D                         | esign Proj      | ect                   | 1        | 3     | 10     |
| CHEM2818               | Physical Cher      | nistry                | 5  | 0  | 12.5     | MATS3524         | P                         | roject (Mate    | erials Engineering    | 3        | 9     | 30     |
| MATS1022               | Materials Pro      | ess Principles        | 2  | 2  | 25       | MATS3544         | P                         | olymer En       | aineerina             | 5        | ŏ     | 12.5   |
| MATS1002               | Microstructura     | I Analysis            | õ  | 3  | 7.5      | MATS4590         | S                         | olidification   | n and Casting         | 0        | 1     | 2.5    |
| MATS1032               | Materials Eng      | ineering 1A           | õ  | 3  | 7.5      | Professional     | al Elec                   | ctives*         |                       | 3        | 3     | 15     |
| MATS1042               | Crystallograph     | ny and X-ray          |    |    |          | Total HPW        | Sess                      | ion 1           | 19                    |          |       |        |
|                        | Diffraction        |                       | 2  | 2  | 10       | Total HPW        | Sess                      | ion 2           | 21                    |          |       |        |
| MATS1052               | Materials Eng      | ineering 1B           | 3  | 0  | 7.5      | Total Credit     | it Poi                    | nts             | 100                   |          |       |        |
| MA151062               | Materials          | operties of           | 4  | 0  | 10       | *A list of Profe | ession                    | al Electives    | will be made availa   | ble a    | t the | end of |
| MATS1072               | Physics of Ma      | terials               | 3  | ŏ  | 7.5      | the Year 3 pro   | ogram                     | and choice      | s for the following y | ear a    | rrive | d at.  |
| MATS1082               | Thermodynan        | nics of               |    |    |          |                  |                           |                 |                       |          |       |        |
|                        | Materials 1        |                       | 0  | 3  | 7.5      |                  |                           |                 |                       |          |       |        |
| MATS1092               | Materials and      | Design 1              | 0  | 2  | 5        |                  |                           |                 |                       |          |       |        |
| MATS1102<br>MATS1112   | Phase Equilib      | ria                   | 0  | 2  | 7.5      |                  |                           |                 |                       |          |       |        |
| General Educa          | ation subject/s    |                       | 2  | 2  | 15       |                  |                           |                 |                       |          |       |        |
| Total HPW Se           | ession 1           | 22                    |    |    |          |                  |                           |                 |                       |          |       |        |
| Total HPW Se           | ession 2           | 22                    |    |    |          |                  |                           |                 |                       |          |       |        |
| Total Credit F         | Points             | 120                   |    |    |          |                  |                           |                 |                       |          |       |        |
| Year 3                 |                    |                       |    |    |          |                  |                           |                 |                       |          |       |        |
| MATH2869               | Applied Statis     | tics SC               | 2  | 0  | 5        |                  |                           |                 |                       |          |       |        |
| MATS1093               | Thermodynan        | nics of               |    |    |          |                  |                           |                 |                       |          |       |        |
|                        | Materials 2        | <b>.</b>              | 2  | 0  | 5        |                  |                           |                 |                       |          |       |        |
| MAIS1113               | Ceramic Proce      | ess Principles 1      | 2  | 0  | 5        |                  |                           |                 |                       |          |       |        |
| MATS1203               | Materials and      | Design 2              | 2  | U  | 5        |                  |                           |                 |                       |          |       |        |
| 1                      | (Unit 1 Design     | for Corrosion         |    |    |          |                  |                           |                 |                       |          |       |        |
|                        | Control)           |                       | 2  | 0  | 5        |                  |                           |                 |                       |          |       |        |
|                        | (Unit 2 Surfac     | e Treatment           |    | -  | _        |                  |                           |                 |                       |          |       |        |
| MATE1042               | and wear)          | 4                     | 0  | 2  | 5        |                  |                           |                 |                       |          |       |        |
| MATS1243<br>MATS1283   | Ferrous Physic     | u<br>val Metallurov B | 0  | 3  | 7.5      |                  |                           |                 |                       |          |       |        |
| MATS2213               | Diffusion          | a molandigy b         | 2  | ŏ  | 5        |                  |                           |                 |                       |          |       |        |
| MATS2223               | Phase Transfo      | ormations             | 0  | 3  | 7.5      |                  |                           |                 |                       |          |       |        |
| MATS3443               | Polymer Scier      | ice and               |    |    |          |                  |                           |                 |                       |          |       |        |
| MATRADOO               | Engineering        |                       | 0  | 6  | 15       |                  |                           |                 |                       |          |       |        |
| MATS/512               | Dislocatione       | Idnics                | 2  | 0  | 5<br>5   |                  |                           |                 |                       |          |       |        |
| MATS4523               | Deformation a      | nd                    | 2  | U  | 5        |                  |                           |                 |                       |          |       |        |
|                        | Strengthening      | Mechanisms            | 0  | 2  | 5        |                  |                           |                 |                       |          |       |        |
| MINE7341               | Mineral Proce      | ss Engineering        | 2  | 0  | 8        |                  |                           |                 |                       |          |       |        |
| General Educa          | ation subject/s    |                       | 0  | 4  | 15       |                  |                           |                 |                       |          |       |        |
| Total HPW Se           | ession 1           | 21                    |    |    |          |                  |                           |                 |                       |          |       |        |
| Total HPW Se           | ession 2           | 20                    |    |    |          |                  |                           |                 |                       |          |       |        |
|                        | ່ວກແລ I            | 0.0                   |    |    |          |                  |                           |                 |                       |          |       |        |

# Graduate Study

# **Course Outlines**

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:

- Doctor of Philosophy, Materials Science and Engineering 1045
- Doctor of Philosophy, Mineral Processing and Extractive Metallurgy 1046
- Master of Science, Materials Science and Engineering
  2055
- Master of Science, Mineral Processing and Extractive Metallurgy 2046
- Master of Engineering in Materials Science and Engineering 2175.

Programs involving formal course work and research leading to the award of Master of Applied Science in Engineering Materials **8065** or Master of Applied Science in Corrosion Engineering **8052** are also available.

Information about research scholarships, fellowships and grants in-aid is available from the Postgraduate Coordinator and graduates are advised to consult him before making a formal application for registration.

## 8065 Engineering Materials

## Master of Applied Science MAppSc

The MAppSc course in Engineering Materials provides a comprehensive study of the full range of materials. The program is designed for graduates wishing to acquire expertise in the selection, use and design capabilities of modern materials. It is particularly appropriate to graduates in other branches of engineering, and to honours graduates in science. The program consists of one year of full-time study (two sessions) or two years of part-time study (four sessions). This is made up of a formal time allocation of 18 hours per week, and will normally be supplemented by additional project work during the summer break. The balance between formal lecture courses and project work will be varied to suit individual student's needs.

|                     |   | HF | w  | CP |
|---------------------|---|----|----|----|
| Compulsory subjects |   |    | S2 |    |
| MATS6475            | Materials Science and                         | 3  | 3  | 15 |
| MATS6485            | Materials Technology                          | 3  | 3  | 15 |
| MATS6405            | Graduate Materials Seminar                    | 2  | 2  | 10 |
| MATS6555            | Minor Graduate Materials<br>Project <i>or</i> | 3  | 3  | 15 |
| MATS6565            | Major Graduate Materials<br>Project           | 9  | 9  | 45 |

## **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. A minimum of two hours per week for one session of elective subjects is required.

Depending on the candidate's background, enrolment in a limited number of unmodified 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.

## 8052 Corrosion Engineering

## Master of Applied Science MAppSc (Corr Eng)

The Master of Applied Science Course in Corrosion Engineering is open to graduates in Engineering, Applied Science or Science who wish to undertake formal studies to promote their careers in industry. The course is designed for those professionals in industry who are faced with the problem of combating corrosion. Its aim is to develop an appreciation of the fundamentals, principles of corrosion and of the available methods whereby it may be overcome.

The program consists of one year's full-time study (2 sessions) or two years' part-time study (4 Sessions). This is made up of a formal time allocation of 18 hours per week and will normally be supplemented by additional project work during the summer break. The balance between formal lecture courses and project work will be varied to suit individual student's needs.

|          |                              | HF        | w  | СР |
|----------|------------------------------|-----------|----|----|
|          |                              | <b>S1</b> | S2 |    |
| MATS1092 | Materials and Design 1       | 0         | 2  | 5  |
| MATS6005 | Corrosion Project            | 6         | 6  | 30 |
| MATS6203 | Design for Corrosion Control | 0         | 2  | 5  |
| MATS6475 | Materials Science and        |           |    |    |
|          | Engineering                  | 3         | 3  | 15 |
| MATS6495 | Corrosion Materials          | 4         | 2  | 15 |
| MATS6535 | Industrial Coatings for      |           |    |    |
|          | Corrosion Protection         | 2         | 0  | 5  |
| MATS6545 | Corrosion Technology         | 3         | 3  | 15 |

\*UNSW graduates who have done MATS9542 (4.952, 5.4222), CIVL2402 (8.240),MATS9530 (4.913), and/or CIVL4403 (8.440) must substitute other appropriate subjects approved by the postgraduate coordinator in the School of Materials Science and Engineering.

# **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.

#### APSE0002

Social Issues in Applied Science Staff Contact: A/Prof CC Sorrell CP5 S1 L/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: School Office CP5 S2 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 CP7.5 S1 L1 T2

Specimen preparation techniques. Principles of optical microscopy. Quantitative microscopy and stereology. Electron microscopy. Microchemical analysis.

#### MATS1011

#### Introduction to Materials Engineering Staff Contact: Dr A G Crosky CP2.5 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 P Wong CP5 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. Word processing, spreadsheets and databases.

#### **MATS1022**

Materials Process Principles Staff Contact: Dr P Wong CP2.5 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: Dr V Sahajwalla CP7.5 S1 L2 T1

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 X-Ray Diffraction Staff Contact: Dr V Sahajwalla CP10 S1 L2 T1

Introduction to crystallography, crystal structure, Bravais lattices, Miller indices. Miller-Bravais indices. Production, absorption and diffraction of X-rays. Powder and single crystal X-ray methods. Stereographic projections. Applications of diffraction methods to solid solutions and solubility limit. Thermal analysis, stress measurement, X-ray fluorescence spectroscopy chemical analysis.

#### **MATS1043**

#### Heat, Fluid and Mass Flow in Materials Processing Staff Contact: Dr V Sahajwalla CP5 S1 L2

In-depth understanding of fundamental principles dictating transport phenomena in materials processing. Development of governing equations related to the transfer of fluid, energy and mass and their inter-dependence based upon fundamentals to analyse and solve problems encountered in current metallurgical operating environments. Application of the understanding developed to the emerging new technologies for metals processing such as direct reduction and smelting for iron-making, near net shape casting.

#### MATS1052

### Materials Engineering 1B

Staff Contact: Dr P Wong CP7.5 S2 L1 T2

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 CP10 S1 L2 T2 Prereguisite: 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 B Gleeson CP7.5 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, anti-ferromagnetism. Elementary perturbation theory, covalent bond; crystal structures, properties. Ionic bond, force.

#### MATS1082

Thermodynamics of Materials 1 Staff Contact: Dr P Wong CP7.5 S2 L2 T1

Fundamental principles of the thermodynamics of closed and open systems. Phase equilibria, the stability and composition of coexisting phases. Chemical potential, fugacities and activities of gases and gas mixtures. The thermodynamics of nucleation and growth of precipitates and spinodal decomposition. Order-disorder in phases. Tabular, analytical and diagrammatic representation of thermodynamic properties. Mass and energy balances. Application of thermodynamics to materials properties and preparation. Models, properties.

#### MATS1092

Materials and Design 1 Staff Contact: Dr AG Crosky CP5 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: A/Prof O Ostrovski CP5 S1 L2

Prerequisite: MATS1082

Thermodynamics of solutions. Partial and integral thermodynamic functions, excess functions. Thermodynamic activity and activity coefficient. Standard states for solute components. Models of solutions. Thermodynamic stability. Calculation of phase diagrams. Perfect and regular ionic solutions. Calculation of chemical equilibria in complex systems.

## MATS1102

Numerical Methods Staff Contact: School Office CP7.5 F L1 T5 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: Dr B Gleeson CP5 S2 L1 T1

Phase rule. Two-component systems: Free energy composition and temperature composition diagrams, solubility limits, compound formation, invariants. Three-component systems: isothermal sections and liquid projections. Solidification and crystallisation: cooling curves, crystallisation paths.

#### MATS1113

Ceramic Process Principles 1 Staff Contact: Mr S Prokopovich CP5 S1 L2

The nature of ceramics. The scope of the ceramic industry, and principal unit operations. Particle packing: two, three and multi-component systems. Forming methods used in the ceramic industry. Drying and firing of ceramics. Glass and other melt forming processes. Hot forming and miscellaneous forming methods.

#### MATS1163

Chemistry of the Solid State Staff Contact: A/Prof CC Sorrell CP5 S2 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, non-oxides, alumino-silicates).

#### MATS1164

Welding Science and Technology CP7.5 Unit 1 Welding Technology Staff Contact: Dr AG Crosky S1 or S2 L1

Fusion welding and allied processed. Capabilities, advantages and limitations.

#### **Unit 2 Welding Metallurgy**

Staff Contact: Dr AG 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.

#### MATS1183 Non-Ferrous Physical Metallurgy Staff Contact: Dr P Krauklis CP5 S1 L1 T1

Constitution, microstructure, processing and properties of non-ferrous alloys. Cast and wrought alloys based on aluminium, copper, magnesium, lead, tin and zinc.

#### MATS1203

#### Materials and Design 2 CP7.5 Unit 1 Design for Corrosion Control Staff Contact: Prof DJ 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

Coatings for corrosion prevention, engineering and decorative purposes. Adhesion. Surface modification. Specifications for coating systems. Selection testing and evaluation of coating. Classification of wear modes. Mechanisms of adhesive and abrasive wear. Selection, testing and evaluation of materials for wear mitigation. Wear-resistance materials.

#### **MATS1214**

#### Welding and other Joining Processes Staff Contact: Dr A Crosky CP5 S1 L1T1

Fusion welding. Capabilities, advantages and limitations. Metallurgical aspects of fusion welding. Cause of welding defects and weldability of carbon and alloy steels, stainless steels, aluminium and other common non-ferrous alloys. Design of welded fabrications to reduce distortion and the risk of failure by fatigue, brittle fracture, etc. Soldering, brazing, adhesive bonding.

#### MATS1224 Materials Characterisation Staff Contact: Dr B Gleeson CP2.5 S1 L5 T5

Materials characterisation by advanced techniques including secondary ion mass spectroscopy (SIMS), auger electron spectroscopy (AES), X-ray photoelectron spectroscopy (XPS) and laser Raman spectroscopy.

#### MATS1234

#### Heat Resisting Alloys Staff Contact: Prof D Young

CP2.5 S1 L1

Microstructure and properties of high temperature alloys, iron-base alloys, nickel-iron alloys, nickel-base alloys and chromium-base alloys, Strengthening mechanisms. Creep, oxidation and hot corrosion. Coatings and protection. Process metallurgy and applications of high temperature alloys.

## MATS1243

Management 1 Staff Contact: Dr P Wong CP7.5 S1 L3

Micro-economic principles. Supply and demand analysis. Comparison of benefits and costs. Macro-economic principles. Fiscal policy. Investment and monetary policy. Inflation and unemployment. Basic accounting concepts. Interpreting financial statements. Management accounting.

The legal environment of business. Contracts. Products and services liability. Industrial relations. Industrial conflict. Wage determination.

Operations management: systems, strategies and benefits. Quality assurance, and quality management systems. The elements of total quality management, TQM.

### MATS1244

Management 2 Staff Contact: Dr P Krauklis CP10 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 inter-group 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.

#### **MATS1254**

Design Project Staff Contact: Dr A Crosky CP10 S1 T1 S2 T3

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.

#### MATS1264

Fibre Reinforced Plastic Composites Staff Contact: Dr A Crosky CP2.5 S1 L1

Philosophy of a composite. Fibre and matrix materials. Design with composites. Fabrication techniques. Properties of composites. Applications..

#### MATS1273

Ferrous Physical Metallurgy A Staff Contact: Dr P Krauklis CP10 S2 L2 T2

Binary and ternary iron-carbon equilibria. Carbon steel, phase transformation, microstructures, heat treatment and mechanical properties. Modification of carbon steel characteristics by alloying elements. Alloy engineering steels, tool and die steels, corrosion and oxidation resistant steels, high strength low-alloy steels. Microstructure and properties of grey, white, malleable, ductile and alloy cast irons.

#### MATS1274 Metal and Ceramic Matrix Composites Staff Contact: Dr S Bandyopadhyay CP2 5 S2 L1

Metal and ceramic matrix composites their advantage and scope; various systems of MMCs and CMCs. Role of interface; fabrication techniques; effect of volume fraction; size and size distribution. Strengthening and toughening mechanisms.

#### **MATS1283**

#### Ferrous Physical Metallurgy B Staff Contact: Dr P Krauklis

CP7.5 S2 L2 T1

Binary and ternary iron-carbon equilibria. Carbon steel, phase transformation, microstructures, heat treatment and mechanical properties. Modification of carbon steel characteristics by alloying elements. Alloy engineering steels, tool and die steels, corrosion and oxidation resistant steels, high strength low-alloy steels. Microstructure and properties of grey, white, malleable, ductile and alloy cast irons.

#### **MATS1284**

Light Alloys Staff Contact: Dr P Munroe CP2 5 S2 L1

Production and processing of titanium alloys. Titanium alloy development. Properties of titanium alloys. Advanced aluminium alloys, rapid solidification of titanium and aluminium alloys. Powder processing of titanium and aluminium alloys. Advanced magnesium alloys.

#### **MATS1294**

Electrical Ceramics Staff Contact: School Office CP5 S1 L1 T1

Defect structure of ionic solids. Ionic conduction: zirconia solid electrolytes, beta-alumina rapid ion conductors, humidity sensors. Electronic conduction: semiconductors, varistors, thermally-sensitive resistors, superconductivity. Ceramic insulators and dielectrics. Piezoelectric, pyroelectric, and electro-optic ceramics. Magnetic ceramics.

#### **MATS1464**

Materials Seminar Staff Contact: A/Prof CC Sorrell CP5 F T1

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: Mr SA Prokopovich CP7.5 S1 L2 T1

General design considerations. Nature and properties of ceramic materials. Effects of composition and microstructure on physical properties of ceramics. Mechanical properties of ceramics: brittleness, hardness and wear resistance, high-temperature capability, static fatigue. Manufacture of ceramic materials. Design approaches of ceramics: empirical, deterministic, probabilistic and linear elastic fracture mechanics. Design of components and selection of materials. Inspection and non-destructive testing.

#### **MATS2123**

Ceramic Process Principles 2 Staff Contact: Mr SA Prokopovich CP5 S212

Plasticity in a clay-water system. Linear drying shrinkage. Air-water vapour system, psychrometry and drying calculations. Effect of porosity on ceramics. Calculations involving ceramic suspensions. Glass, glaze and porcelain enamel calculations. Relationship between the composition and physical properties of glasses. Rational analysis of clay and fluxing materials. Body formulation. Flue gas analysis and combustion calculations. ceramic laboratory instrumentation. Safety aspects in ceramics.

#### MATS2133

## Ceramic Raw Materials

Staff Contact: Mr SA Prokopovich CP5 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 SA Prokopovich CP5 S2 L2

The principles of operation, construction and fields of application of equipment used in the ceramic industry in the following areas: preparation of raw materials and auxiliary processing operations; forming, drying and firing of ceramic products.

#### **MATS2153**

Ceramic Processing Laboratory Staff Contact: Mr SA Prokopovich CP10 S2 T4

Laboratory program 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 CC Sorrell CP5 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.

#### **MATS2203**

Physico Chemical Ceramics Laboratory Staff Contact: Mr S Prokopovich CP10 S1 T4

Laboratory program 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.

## MATS2213

Diffusion Staff Contact: Prof DJ Young CP5 S1 L1 T1

Fick's first and second laws. Solutions for short and long times by analytical and numerical methods. Boundary conditions for solid-fluid and solid-solid interfaces. Diffusion couples. Atomic level diffusion theory

#### **MATS2223**

Phase Transformations Staff Contact: Dr B Gleeson

CP7.5 S2 L2 T1

Solidification: single phase, eutectic and neareutectic, peritectic. Diffusional transformation: percipitation, ripening, cooperative transformations, TTT and CCT curves. Diffusionless transformations: crystallography, nucleation and growth modes.

#### **MATS2254**

#### Ceramic Engineering Design

Staff Contact: Mr SA Prokopovich CP5 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 CC Sorrell CP5 S1 L1.5 T5

Defects and phase transitions. Recrystallisation, grain growth, and nucleation. Stages of sintering. Transport mechanisms, different modes of sintering (vapour, liquid, reactive liquid, solid), additives, and hot pressing. Secondary phenomena (oxidation, decomposition, phase transformations, trapped gases, non-uniform mixing, overfiring), time-temperature effects, firing shrinkage, and warpage.

#### **MATS2273**

Chemistry of Ceramic Processes Staff Contact: A/Prof CC Sorrell CP5 S1 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.

#### **MATS2284**

#### **Thermal Properties of Ceramics**

Staff Contact: A/Prof CC Sorrell CP5 S2 L2

Heat capacity, measurement of heat capacity and factors affecting heat capacity. Thermal expansion, measurement of thermal expansion and factors affecting thermal expansion. Thermal conductivity, thermal diffusivity, measurement of thermal conductivity and thermal diffusivity, factors affecting thermal transport, phonon and photon conductivity and factors affecting phonon and photon conductivity. Thermal stresses and thermal shock. Influence of structure and composition of pure materials on thermal conductivity of multiphase ceramics.

#### MATS3443

Polymer Science and Engineering Staff Contact: Dr S Bandyopadhyay CP15 S2 L4 T2

Polymer structure. Mers, bond strength, functionality. Addition and condensation polymerization. Chain branching, cross linking, crystallinity. Thermosets and thermoplastics. Copolymers, blending, plasticisers. Polymer orientation. Polymer tailoring. Melt, glass and lower transitions. Effect of chemical molecular structure on performance. Elastomers, fibres, foams, composites. Elementary polymer identification. Common families of commodity plastics, engineering plastics and elastomers.

#### **MATS3524**

Project

Staff Contact: Dr B Gleeson CP30 S1 T3 S2 T9

An experimental or technical investigation or design related to some aspects of materials engineering in the specific discipline (ceramic engineering, metallurgical engineering or materials engineering).

## MATS3544

Polymer Engineering Staff Contact: Dr S Bandyopadhyay CP15 S1 L3.5 T1.5

Mechanical behaviour of polymers. Critical effects of temperature variation on behaviour of thermoplastics under load. Comparison with thermosets. Factors contributing to strength and toughness. Viscoelasticity. Yielding, deformation and fracture. Elastomer performance. Effect of strain rate. Crazing. Effect of environment. Strategies to reduce stress and increase toughness. Creep, recovery and stress relaxation. Time-temperature superposition. Fatigue. Selection of commodity plastics, engineering plastics and elastomers for particular applications. Degradation. Processing of polymers.

#### MATS4154

Mechanical and Thermal Processing of Metals Staff Contact: Dr AG Crosky CP2.5 S1 L1

Mechanisms of deformation. Annealing. Development of deformation and annealing textures. Superplasticity..

#### MATS4204

Industrial Metallurgy Project Staff Contact: School Office CP15 F3

An experimental investigation of some aspect of industrial metallurgy.

## MATS4333

Fracture Mechanics Staff Contact: Dr A Crosky CP5 S1 L1 T1

Linear elastic fracture mechanics: modes of loading, stress intensity factor concept, effect of finite boundaries, energy release rate concept. Fracture toughness testing and evaluation; ASTM E399 and alternative specimen types. Subcritical fracture mechanics; fatigue, stress corrosion cracking. Elastic-plastic fracture mechanics; crack opening displacement, J-integral.

#### MATS4513 Deformation of Metals Staff Contact: School Office CP5 S1 L2

Atomic and molecular description of deformation. Introduction to dislocation theory and its application to mechanical properties.

#### **MATS4523**

#### Strengthening Mechanisms in Metals Staff Contact: Dr B Gleeson CP5 S2 L1 T1

Strengthening mechanisms, creep, fracture, grain size dependence of strength. Introduction to generation of deformation and recrystallisation textures. Measurements of age-hardening, activation energy of strain ageing.

#### **MATS4533**

Metal Forming Processes Staff Contact: Dr AG Crosky CP5 S1 L2

Metal forming. Introduction to metal forming operation. Factors affecting deformation and workability. Hot working, cold working and recrystallisation. Processes: forging, rolling, extrusion and wire drawing. Die materials and geometry. Deformation parameters and processing defects. Plant visits.

#### **MATS4543**

Fractographic Analysis Staff Contact: Dr AG Crosky CP7.5 S2 L1 T2

Classification of macroscopic and microscopic fracture mechanisms. Initiation and propagation of ductile, brittle, fatigue, 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.

#### MATS4553

Non-Destructive Testing Staff Contact: Dr AG Crosky CP2.5 S2 L1

Concepts of quality assurance and quality control. Techniques of liquid penetrant, magnetic particle ultrasonic and radiographic inspection. Systems and processes, inspection and evaluation.

#### MATS4580

#### Electrometallurgy of Steel and Ferroalloys Staff Contact: A/Prof O Ostrovski CP2.5 S2 L1

Electric arc furnace (EAF) steelmaking. Energy, raw materials and consumables. Basic principles of EAF. Technology of EAF steelmaking. Modern EAF steelworks. Induction furnaces. Secondary steelmaking. Remelting processes. Basic principles of EAF ferroalloymaking. Technology of silicon, manganese and chromium alloys production.

#### MATS4590

Solidification and Casting Staff Contact: Dr V Sahaywalla CP2.5 S2 L1

Understanding the fundamentals of solidification (cast structure development, high temperature properties) in casting processes. Emphasis on conventional and emerging near net shape casting processes. Application of the solidification fundamentals to understand mechanisms of various quality problems encountered in these processes. Process optimisation (machine design, chemistry, temperature, heat extraction) to control casting defects).

### MATS5213

Metallurgical Plant Practice Staff Contact: Dr P Wong CP2.5 S1 or S2 T1

Up to 2 days of metallurgical plant inspections and case studies equivalent to14 tutorial hours are associated with this subject. Ferrous and non-ferrous plant practice.

#### **MATS5253**

Metallurgical Reaction Engineering Staff Contact: A/Prof O Ostrovski CP5 S1 or S2 L2

Metallurgical reactor design: batch and continuous reactors. Gas-solid reactions. Limiting laws for gas-liquid reactions in steelmaking processes. Liquid-liquid reactions, design of extractive and refining operations.

## MATS5263

Extractive Metallurgy Staff Contact: A/Prof O Ostrovski CP17.5 S1 L3 S2 L2 T2

A review of units of operations in extractive metallurgy: roasting, sintering, smelting and refining. Iron blast furnace. Alternative ironmaking, direct reduction and smelting. Oxygen steelmaking. Electric arc furnace. Ladle metallurgy. Copper, lead and zinc smelting. Aluminium production.

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 electrorefining.

#### MATS5314

#### Kinetics and Mass Transfer in Metallurgical Processes Staff Contact: Dr A Yu

CP10 S1 L1 S2 L2 T1

Kinetics and mass transfer in metallurgical processes. Kinetics of interphase transfer in metallurgical systems. Single particle, fluid/solid reactions, topochemical reactions, reactions of porous solids. Application to reduction of iron oxides. Reaction between liquid metals and gases, reactions involving drops and bubbles. Reaction between liquid metals and slags, mass transfer at bubble stirred interfaces. Application to metal refining process. Vacuum degassing and refining processes.

#### **MATS5324**

#### Modelling Metallurgical Processes Staff Contact: Dr P Wong CP10 S2 L4

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, coalescance of inclusions, modelling metal flow and solidification, blast furnace drainage.

#### **MATS5384**

#### Air Pollution Control in the Metallurgical Industry Staff Contact: Dr V Sahajwalla CP2.5 S1 or S2 L1

Air pollutants from the different metallurgical industries. Technical principles and equipment to control the emission of pollutants. Examples from the primary and secondary metallurgical industries.

#### MATS6005

Corrosion Project Staff Contact: School Office CP30 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 DJ Young

CP5 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.

#### MATS6405

#### Graduate Materials Seminar Staff Contact: School Office CP10 F HPW2

Instruction in written and 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 CP15 F L2 T1

The characteristics of crystalline solids. Defect structure of crystals and influence of defects on their mechanical behaviour. Micromechanism of elastic and plastic deformation. Microstructure and structure-property relationships of the main types of engineering materials (Metals, Ceramics, Polymers and Composites). Phase Equilibria of alloys; microstructural control by thermomechanical processing and application to commercial engineering materials. Fracture mechanisms for ductile, brittle, creep and fatigue modes of failure in service. Metallic corrosion and degradation of other classes of materials. Polymer materials: The structure and properties of polymers. Mechanisms for the modification of properties. Ceramic materials: The structure and properties of ceramics. Composite materials. Design and development of materials for specific engineering applications. Appropriate laboratory and tutorial work.

### MATS6485

#### Materials Technology

Staff Contact: School Office CP15 F L1.5 T1.5

Material properties and their effect on 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. Atomic and microstructure determination: X-ray production, absorption and diffraction using powder and single crystal methods. Stereographic projections and crystal geometry. Application of diffraction methods to solid solutions and solubility limit, thermal analysis, stress measurement, and chemical stream analysis. Electron optics and analysis. Transmission and scanning electron microscopy. Energy-loss spectrometers. Microanalysis.

#### MATS6495

#### Corrosion Materials Staff Contact: School Office

CP15 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.

#### MATS6535

Industrial Coatings for Corrosion Protection Staff Contact: School Office CP5 S1 L2

Special topics on heavy-duty organic, inorganic and metallic coatings used in atmospheric, marine and industrial environments.

#### MATS6545

Corrosion Technology Staff Contact: School Office CP15 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

CP15 F HPW3

A small technical investigation or a design project, including a written report.

#### MATS6565

Major Graduate Materials Project Staff Contact: School Office CP45 F HPW9

A substantial experimental or theoretical investigation, or design project, including a written thesis.

#### MATS7132 Structure and Properties of Metallurgical Phases Unit 2 only Staff Contact: A/Prof O Ostrovski CP2.5 S1 or S2 L1

The atomistic and microsopic approach to melts in process metallurgy, liquid metals and slags. Relationships between melt structure, mechanism and reaction kinetics in smelting and refining operations.

#### **MATS7134**

#### Structure and Properties of Metallurgical Phases Unit 1 Structure and Properties of Solids Staff Contact: School Office CP7.5 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: A/Prof O Ostrovski S1 or S2 L1

The atomistic and microscopic approach to melts in process metallurgy, liquid metals and slags. Relationships between melt structure, mechanism and reaction kinetics in smelting and refining operations.

#### MATS7144

Powder Metallurgy Staff Contact: School Office CP5S1 or S2 L1

Mechanisms of sintering in metals. Techniques of powder metallurgy, compaction, powder characteristics. Sintering in the presence of liquid phase, cementation, cermets. Preparation of super-alloys.

#### MATS7244

Advanced Electron Optics Staff Contact: School Office CP5 S1 or S2 L1 T1

See School for details.

#### **MATS7470**

Polymer Processing and Fabrication Staff Contact: Dr S Bandyopadhyay CP10 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: Dr S Bandyopadhyay CP5 S2 L2

Designing with polymeric materials. Selection and compounding of rubbers. Rubber modification of plastics. Polymer blending, mixing and recycling. Design of plastic and rubber components. Plant visits.

#### **MATS7490**

High Temperature Techniques Staff Contact: School Office CP2 5 S1 or S2 L1

Experimental methods for the determination of thermophysical and thermochemical properties at elevated temperatures.

#### MATS7500

Mathematical Plasticity Staff Contact: Dr P Wong CP2.5 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.

#### **MATS9421**

Materials for Mining Engineers Staff Contact: Dr P Krauklis CP10 S1 L2 T1 S2 L1

Session 1: Microstructure, phase equilibrium and properties of steels, light alloys, ceramics, polymer and composites. Metal forming by casting and mechanical working. Elastic and plastic deformation, recrystallisation, fracture, corrosion.

Session 2: Characterisation of materials by mechanical testing. Abrasive wear: gouging, high stress and low stress abrasion. Mitigation of abrasion. Abrasion resistant materials.

#### MATS9520 Engineering Materials Staff Contact: Dr AG Crosky CP7.5 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, ferous and non-ferrous microstructures and fracture and failure analysis.

#### MATS9530

Materials Engineering Staff Contact: A/Prof CC Sorrell

CP7.5 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 CP10 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: Dr O Ostrovski CP5 S1 L2

Principles and development of pyrometallurgical processes and a review of the unit operations, roasting, sintering, smelting and refining for the treatment of ferrous and non-ferrous minerals.

#### MATS9712

Materials and Techniques in Design Craft 1 Staff Contact: A/Prof CC Sorrell

CP10 S1 L2 T1

An introduction to the science and technology of materials, emphasizing relationships between structure, composition and properties. Introduction to processing of metallic, ceramic and fibrous materials. Materials recognition and design possibilities are discussed.

#### MATS9722

Materials and Techniques in Design Craft 2B Staff Contact: A/Prof CC Sorrell CP7.5 S2 L1.5 T1.5

Casting, working and surface finishing of metals and alloys. Soldering, brazing and welding. Joining metals to glasses, ceramics and gemstones.

#### MATS9732

Materials and Techniques in Design Craft 2C Staff Contact: A/Prof CC Sorrell CP7.5 S2 L1.5 T1.5

Structures and properties of clays, non-clays, cements, porcelains, glazes, glasses and other ceramics. optical properties and colours of glasses, glazes and gemstones. Forming and firing of ceramic bodies, reactions during firing. Kilns and oxidation/reduction effects.

# **School of Mines**

Head of School Associate Professor GR Taylor

#### Administrative Officer

Ms R Benninghaus

The School of Mines, which was formed in 1986, consists of two Departments and three Centres corresponding to the main professions on which the mining and minerals industry of Australia depend. These are the Departments of Applied Geology and Mining Engineering, and the Centre for Minerals Engineering (in conjunction with the School of Chemical Engineering), the UNSW Groundwater Centre (in conjunction with the School of Civil Engineering), and the Key Centre for Mines.

The Key Centre for Mines provides a full range of education and training services to the minerals industry and offers graduate courses in mining management. The UNSW Groundwater Centre offers specialised graduate courses in groundwater studies and carries out general teaching in hydrogeology. The Centre for Minerals Engineering coordinates and conducts teaching and research activities of relevance to the minerals industry. It offers professional electives in minerals engineering to undergraduate students enrolled in the BE course in Chemical Engineering.

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 Minerals 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. Geologists are also involved in control of ore grades during the mining operation and in environmental management during and after mining. The Mining Engineer decides on the mining method, assesses the financial viability of the project, 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. Groundwater geologists are employed in many fields including mining, civil engineering, water resources management and environmental management.

Each is an expert in her or his own field, but each also needs to have a good appreciation of the work of the others. 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 discipline, 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 CR 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

# **Undergraduate Study**

## **Course Outlines**

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 in four stages normally taken over four years full-time study, with honours for students who perform with merit throughout the course program. The fourth stage can be taken part time over two years, normally Years 4 and 5.

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 should take chemistry at the introductory level (CHEM1401 and CHEM1101) in Year 1, and CHEM1201 in the summer session before commencing Year 2.

Reciprocal courses are offered through the Board of Studies in Science and Mathematics in Geology (double major), Geochemistry, 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 achieving a good academic standing. 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.

## 3000 Applied Geology Full-time

Bachelor of Science BSc

|                      |   | HPW<br>S1 S2 |   | СР |  |
|----------------------|---|--------------|---|----|--|
| Stage 1              | Introductory Chamistry A                | ~            | • |    |  |
| and                  | Introductory Chemistry A                | 6            | 0 | 15 |  |
| CHEM1101<br>CHEM1201 | Chemistry 1A <i>and</i><br>Chemistry 1B | 0            | 6 | 15 |  |
| or                   | Chemistry 15                            | U            | 0 | 15 |  |
| CHEM1101             | Chemistry 1A and                        | 6            | 0 | 15 |  |
| CHEM1201             | Chemistry 1B                            | 0            | 6 | 15 |  |
| GEOL1101             | Geological Processes and                | 5            | 0 | 15 |  |
| GEOL1201<br>one of:  | Geological Environments                 | 0            | 5 | 15 |  |
| MATH1011             | General Mathematics 1B                  | 6            | 0 | 15 |  |
| MATH1131             | Mathematics 1A                          | 6            | 0 | 15 |  |
| MATH1141             | Higher Mathematics 1A                   | 6            | 0 | 15 |  |
| and one of:          |   |              |   |    |  |
| MATH1021             | General Mathematics 1C                  | 0            | 6 | 15 |  |
| MATH1231             | Mathematics 1B                          | 0            | 6 | 15 |  |
| MATH1241             | Higher Mathematics 1B                   | 0            | 6 | 15 |  |
| and either:          |   |              |   |    |  |
| PHYS1002             | Physics 1 or                            | 6            | 6 | 30 |  |
| PHYS1022             | Introductory Physics                    | 6            | 6 | 30 |  |
| or                   |   |              |   |    |  |
| BIOS1101             | Evolutionary and Functional             |              |   |    |  |
|                      | Biology and either                      | 6            | 0 | 15 |  |
| BIOS1201             | Molecules, Cells and Genes or           | 0            | 6 | 15 |  |
| BIOS1301             | Biology of Australia Flora              |              |   |    |  |
|                      | and Fauna <i>or</i>                     | 0            | 6 | 15 |  |
| or                   |   |              |   |    |  |
| GEOG1073             | Environmental Processes and             | d            |   |    |  |
|                      | Analysis <i>and</i>                     | 0            | 6 | 15 |  |
| <i>G</i> EOG1064     | Global Development,                     |              |   |    |  |
|                      | Economy and Environment                 |              |   |    |  |
|                      | in Australia                            | 6            | 0 | 20 |  |
|                      |   |              |   |    |  |
| Total HPW Se         | ession 1 24                             |              |   |    |  |
| Total HPW Se         | ession 2 24                             |              |   |    |  |
| Total Credit F       | Points 125                              |              |   |    |  |

|                              |                               | HP<br>S1 | W<br>S2 | СР   |                |                                  | HF<br>S1 | w<br>S2 | СР |
|------------------------------|-------------------------------|----------|---------|------|----------------|----------------------------------|----------|---------|----|
| Stage 2                      |                               |          |         |      | Stage 4        |                                  |          |         |    |
| GEÖL2011                     | Mineralogy and Igneous        |          |         |      | APSE0002       | Social Issues in Applied         | ~        | ~       | -  |
|                              | Petrology                     | 5        | 0       | 15   |                | Science                          | 2        | U       | 5  |
|                              | Field                         | 1        | 0       |      | GEOL4111       | Advanced Geological              | 6        | 0       | 15 |
| GEOL2031                     | Sedimentology and             | ~        | ~       | 45   |                | Professional Practice            | 4        | ň       | 15 |
|                              | Palaeontology                 | 5<br>1   | 0       | 15   | GEOL4121       | Special Topics in Applied        | -        | v       |    |
|                              | Potrology and Structural      |          | U       |      | acor4101       | Geology                          | 8        | 0       | 25 |
| GEUL2022                     | Geology                       | 0        | 5       | 15   | GEOL4203       | Field Project                    | Ō        | 20      | 60 |
|                              | Field                         | ŏ        | ĭ       |      |                | action 1 20                      |          |         |    |
| GEOL2041                     | Geological Computing          | 3        | ò       | 7.5  | Total HPW Se   | ession 2 20                      |          |         |    |
| GEOL2042                     | Geological Statistics         | 3        | 0       | 7.5  | Total Credit F | Points 120                       |          |         |    |
| GEOL2051                     | Introductory Geophysics       | 0        | З       | 15   | Total Oroalt I |                                  |          |         |    |
|                              | Field                         | 0        | 1       |      |                |                                  |          |         |    |
| GEOL2062                     | Geological Mapping            | 0        | 4       | 15   | 2000           |                                  |          |         |    |
| GEOL2072                     | Environmental Geology         | 0        | 3       | 7.5  |                | - Is as Davit time               |          |         |    |
| GEOL2092                     | Geochemistry                  | 0        | 3       | 7.5  | Applied Ge     | ology Part-time                  |          |         |    |
| General Educa                | ation subject/s               | 2        | 2       | 15   | Bachelor of    | Science                          |          |         |    |
| Total HPW Se<br>Total HPW Se | ession 1 20<br>ession 2 23    |          |         |      | BSc            |                                  |          |         |    |
| <b>Total Credit P</b>        | Points 120                    |          |         |      | Part-time stud | ly is only available in Stage 4. |          |         |    |
|                              |                               |          |         |      | Stage 4 (P/T)  | , , ,                            |          |         |    |
| Stage 3                      | Mineralegical Techniques      | 2        | 0       | 75   | APSE0002       | Social Issues in Applied         |          |         |    |
| GEOL3011                     | Inneralogical Techniques      | 3        | U       | 1.5  | / 020002       | Science                          | 2        | 0       | 5  |
| GEOL3021                     | Processes                     | 3.5      | 0       | 15   | GEOL4131       | Special Topics in Applied        |          |         |    |
|                              | Field                         | 0.5      | õ       |      |                | Geology                          | 8        | 0       | 25 |
| GEOL3031                     | Stratigraphy and Basin        |          |         |      | GEOL4213       | Field Project (P/T)              | 0        | 10      | 30 |
|                              | Analysis*                     | 4        | 0       | 22.5 | Total HPW S    | ession 1 10                      |          |         |    |
|                              | Field                         | 2        | 0       |      | Total HPW S    | ession 2 10                      |          |         |    |
| GEOL3052                     | Exploration Geophysics        | 0        | З       | 15   | Total Credit   | Points 60                        |          |         |    |
|                              | Field                         | 0        | 1       |      |                |                                  |          |         |    |
| GEOL3072                     | Engineering Geology           | 0        | 3       | 7.5  | Stage 5 (P/T)  |                                  |          |         |    |
| GEOL3082                     | Structural Geology            | 0        | 3       | 15   | GEOL4111       | Advanced Geological              | 6        | 0       | 15 |
|                              | Field                         | 0        | 2       | 75   | 05014101       | Profossional Practica            | 4        | 0       | 15 |
| GEOL3092                     | Oro Doposite                  | 5        | 2       | 15   | GEOL4121       | Field Project (P/T)              | - Ā      | 10      | 30 |
| GEOLSIUI                     | Field                         | 1        | ŏ       |      |                |                                  | v        |         |    |
| GEOL3102                     | Fossil Fuels and Non-metallic | ; Ó      | 5       | 15   | Total HPW S    | ession 1 10                      |          |         |    |
| 32020102                     | Resources                     | -        | -       |      | Total HPW S    | ession 2 IU<br>Pointe 60         |          |         |    |
|                              | Field                         | 0        | 1       |      | i otal Credit  |                                  |          |         |    |
| General Educ                 | ation subject/s               | 2        | 2       | 15   |                |                                  |          |         |    |
| Total HPW Se                 | ession 1 21                   |          |         |      |                |                                  |          |         |    |
| Total HPW Session 2 21       |                               |          |         |      |                |                                  |          |         |    |

Total Credit Points 135

# **Graduate Study**

A number of coursework Masters degrees are available through the Department of Applied Geology. In addition, the Department offers the research degrees of Doctor of Philosophy PhD in Applied Geology **1000** and Master of Science MSc in Applied Geology **2000**.

# **Course Outlines**

## 8022 Applied Geology

Master of Applied Science MAppSc

Master of Applied Science courses in Applied Geology 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.

Specialist programs currently offered are in the fields of Engineering Geology, Hydrogeology, Environmental Geology, Groundwater Studies and Geological Data Processing.

#### **Alternative Graduate Programs**

Alternative Graduate Programs in association with the Department of Applied Geology are available in the following areas:

#### **Department of Safety Science**

**8045** Environmental Studies Graduate Course (MEnvStudies)

#### School of Geography

5047.2000 Graduate Diploma in Remote Sensing (GradDip) 8047.2000 Remote Sensing Graduate Course (MAppSc) Faculty of Engineering

5496 Graduate Diploma in Remote Sensing (GradDip) 8641 Remote Sensing Graduate Course (MEngSc)

## 8022.1000 Engineering Geology/ Hydrogeology/Environmental Geology

This is a flexible program covering a range of geotechnical disciplines. Completion of the course requires 120 credit points of which up to 96 (and no less than 60) credit points should be coursework subjects. The balance is made up of a research project of 24, 36 or 60 credit points which may be completed internally or externally. Most subjects are given in the first session, but some are available in second session, or in short course or external format. Core subjects should discuss their choice of subjects with the Program Director, Mr GH McNally.

| Core subjects  | 5                                     | СР  |
|----------------|---------------------------------------|-----|
| CIVL9788       | Site Investigation                    | 12  |
| CIVL9860       | Investigation of Groundwater          |     |
|                | Resources                             | 12  |
| GEOL9030       | Geotechnical Engineering              | 12  |
| GEOL9040       | Fundamentals of Geomechanics          | 12  |
| GEOL9060       | Environmental Geology                 | 12  |
| Project        |                                       |     |
| GEÓL9444       | Project or                            | 24  |
| GEOL9454       | Project or                            | 36  |
| GEOL9464       | Project                               | 60  |
| Elective subi  | ects                                  | ĊP  |
| CIVL9790       | Stability of Slopes                   | 12  |
| GEOL0110       | Geological Remote Sensing             | 12  |
| GEOL9031       | Engineering Geology of Surficial      |     |
|                | Deposits                              | 12  |
| GEOL9032       | Soil and Rock Construction Materials  | 12  |
| GEOL9033       | Terrain Evaluation                    | 12  |
| GEOL9070       | Engineering Geophysics                | 12  |
| Other elective | subjects may be drawn from those offe | red |
| by the Key Ce  | ntre for Mines, UNSW Groundwater      |     |
| Centre and the | School of Civil Engineering.          |     |

## 8022.2000 Groundwater Studies

This program is coordinated through the UNSW Groundwater Centre. Candidates are required to complete 120 credit points, 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 with core subjects totalling 60 credit points.

| Core subjects  | 6                                 | СР |
|----------------|-----------------------------------|----|
| CIVL9860       | Investigation of Groundwater      |    |
|                | Resources                         | 12 |
| CIVL9875       | Hydrological Processes            | 12 |
| CIVL9891       | Groundwater Contamination and     |    |
|                | Remediation                       | 12 |
| GEOL9010       | Groundwater Environments          | 12 |
| GEOL9051       | Hydrogeochemistry                 | 12 |
| Project        |                                   |    |
| GEOL9124       | Groundwater Project or            | 36 |
| GEOL9144       | Groundwater Project               | 48 |
| Elective subje | ects                              |    |
| CIVL9799       | Environmental Geomechanics        | 12 |
| CIVL9880       | Groundwater Modelling             | 12 |
| CIVL9890       | Spatial Decision Support          |    |
|                | Systems in Water Resources        | 12 |
| GEOL9052       | Advanced Hydrogeochemistry        | 12 |
| GEOL9070       | Engineering Geophysics            | 12 |
| GEOL9100       | Remote Sensing of Groundwater     |    |
|                | Resources                         | 12 |
| KCME1110       | Geographic Information Systems in |    |
|                | Applied Geology                   | 12 |

## 8022.3000 Geological Data Processing

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 120 credit points including either a 24 or 48 credit point project. Alternative subjects may be substituted in the published program at the discretion of the Head of the Department.

#### Core subjects (12 credit points)

| GEOL0300 | Computing and Statistics for Geologists* |
|----------|--|
| GEOL0310 | Image Processing of Spatial Data Sets    |
| GEOL0320 | Geostatistical Ore Reserve Estimation    |

#### Project

| GEOL0304 | Project 1 (24 credit points) or |
|----------|---------------------------------|
| GEOL0314 | Project 2 (48 credit points)    |

#### Elective subjects (12 credit points)

#### Technical

| 100111100 |   |
|-----------|---|
| 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                      |
| KCME4303  | Mine Geology and Grade Control                |

#### **Business Management**

KCME4201Export Marketing for the Mining IndustryKCME4202Mine Evaluation and Project AssessmentKCME4203Mine ManagementKCME4204Exploration Project ManagementKCME4301Environmental Management for the Mining<br/>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

# **Department of Mining Engineering**

## **Head of Department**

### Professor JM Galvin

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 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 Manager's 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.

# **Undergraduate Study**

## **Course Outlines**

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. A five-year combined degree course is also available in Civil Engineering and Mining Engineering.

## 3140 Bachelor of Engineering BE

Year 1 of the course is similar to that of several other Engineering courses and Year 2 includes those subjects which are 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.

Some subjects in Years 3 and 4 of the course will be conducted at the Department's residential Underground Teaching Unit located at Wyee Coal Mine. This provides a unique opportunity for students to gain immediate practical insight into theoretical concepts. 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 as much as possible in securing suitable vacation employment. Students are required to submit for assessment an industrial training report on the vacation and other relevant experience acquired.

|                      |  | HP     | W      | СР   |  |
|----------------------|--|--------|--------|------|--|
| Veer 1               |  | 31     | 52     |      |  |
| CHEM1807             | Chemistry 1 ME<br>Mathematics 1A <i>or</i> | 4      | 0      | 15   |  |
| MATH1141<br>MATH1231 | Higher Mathematics 1A<br>Mathematics 1B or | 6      | 0      | 15   |  |
| MATH1241             | Higher Mathematics 1B                      | 0      | 6      | 15   |  |
| MINE0010             | Applied Mechanics                          | 3      | 0      | 12   |  |
| MINE0110             | Stress Analysis 1                          | 0      | 3      | 12   |  |
| MINE0210             | Introduction to Mining                     |        |        |      |  |
|                      | Engineering*                               | 1      | 0      | 6    |  |
| MINE0410             | Technical Communication                    | 0      | 2      | 7    |  |
| MINE0710<br>PHYS1002 | Computing 1<br>Physics 1                   | 0<br>6 | 2<br>6 | 30   |  |
| Total HPW Se         | ession 1 20                                |        |        |      |  |
| Total HPW Se         | ession 2 19<br>Deinte 119                  |        |        |      |  |
| Total Credit I       | -01118 119                                 |        |        |      |  |
| Year 2               |  |        |        |      |  |
| ELEC0807             | Electrical Engineering 1E                  | 0      | 3      | 7.5  |  |
| GEOL5211             | Geology for Mining                         | ~      | ~      | 10   |  |
| 011470444            | Engineers 1                                | 2      | 2      | 11.5 |  |
| GMATU441             | Surveying for Engineers                    | 4      | 4.5    | 20   |  |
| MATH2009             | Statistice SA                              | 2      | 2      | 10   |  |
| MATS9421             | Materials for Mining                       | -      | -      |      |  |
| MA103421             | Engineers                                  | 3      | 1      | 10   |  |
| MINE0120             | Stress Analysis                            | 3      | Ó      | 10   |  |
| MINE1320             | Fluid Mechanics and                        |        |        |      |  |
|                      | Thermodynamics                             | 2      | 1      | 10   |  |
| MINE1321             | Mine Water and Drainage                    | 0      | 1      | 3    |  |
| MINE1420             | Elements of Mining                         | 1      | 0      | 6    |  |
| PHYS2920             | Electronics                                | 3      | 0      | 7.5  |  |
| General Educ         | ation subject/s                            | 2      | 2      | 15   |  |
| Total HPW S          | ession 1 22                                |        |        |      |  |
| Total HPW S          | ession 2 20.5<br>Points 120.5              |        |        |      |  |
| fotal ofcall         |  |        |        |      |  |
| Year 3               |  |        |        |      |  |
| GEOL5311             | Geology for Mining                         | ~      | ~      |      |  |
| 014470500            | Engineers 2                                | 3      | 3      | 20   |  |
| GMAT0580             | Mining Surveying                           | 3      | U      | 7.5  |  |
| MINE 1131            | Deposite                                   | 3      | 0      | 10   |  |
| MINE1132             | Mining of Coal Deposits                    | 3      | õ      | 10   |  |
| MINE1231             | Rock Mechanics                             | Õ      | 4      | 10   |  |
| MINE1232             | Soil Mechanics                             | 0      | 2      | 6    |  |
| MINE1330             | Bulk Materials Handling and                |        |        |      |  |
|                      | Transport                                  | 0      | 2      | 6    |  |
| MINE1530             | Power Supply in Mines                      | 2      | 0      | 6    |  |
| MINE1630             | Excavation Engineering                     | _      | _      |      |  |
|                      | (Blasting)                                 | 2      | 0      | 6    |  |
| MINE1631             | Excavation Engineering                     | ~      |        | ~    |  |
|                      | (Machine Mining)                           | υ      | 1      | 3    |  |
| MINE1830             | Nine venulation and                        | ^      | л      | 10   |  |
| MINE 1020            | Environment<br>Industrial Training         | 0      | 4      | 10   |  |
| MINE 1930            | Minerals Engineering                       | U      | U      | v    |  |
| MINE/042             | Processes                                  | 2      | 2      | 12   |  |
| General Educ         | cation subject/s                           | 2      | 2      | 15   |  |
|                      | ansion 1                                   |        |        |      |  |
| Total HDW S          | lession 2 20                               |        |        |      |  |
| Total Credit         | Points 121.5                               |        |        |      |  |

|   |                           | HPW |    | СР |  |  |
|---|---------------------------|-----|----|----|--|--|
|   |                           | 51  | 52 |    |  |  |
| Year 4  |                           |     |    |    |  |  |
| APSE0002  | Social Issues in Applied  |     |    |    |  |  |
|   | Science                   | 2   | 0  | 5  |  |  |
| MINE1140  | Geotechnical Engineering  | 2   | 2  | 12 |  |  |
| MINE1740  | Mining Legislation        | 0   | 2  | 6  |  |  |
| MINE2141  | Mineral Economics         | 2   | 0  | 6  |  |  |
| MINE2142  | Mine Planning and Design  | 3   | 3  | 20 |  |  |
| MINE2240  | Mining Management         | 0   | 3  | 10 |  |  |
| MINE3040  | Mine Safety Engineering   | 0   | 3  | 10 |  |  |
| MINE3041  | Hazard and Risk in Mining | 2   | 0  | 6  |  |  |
| MINE4140  | Minerals Industry Project | 4   | 4  | 24 |  |  |
| MINE4240  | Industrial and Research   |     |    |    |  |  |
|   | Seminars                  | 1   | 1  | 5  |  |  |
| MINE4540  | The Mining Engineering    |     |    |    |  |  |
|   | Profession in Society     | 0   | 2  | 5  |  |  |
| together with an approved group of two advanced |                           |     |    |    |  |  |
| cicolive subje                                  |                           | 3.  |    |    |  |  |

## **Advanced Electives**

| MINE1940               | Tunnel Engine | eering and Shaf | t |   |   |
|------------------------|---------------|-----------------|---|---|---|
|                        | Sinking       | •               | 2 | 0 | 5 |
| MINE7440               | Mineral Proce | ss Technology   | 2 | 0 | 5 |
| MINE3140               | Computationa  | I Methods in    |   |   |   |
|                        | Geomechanic   | s               | 2 | 0 | 5 |
| MINE3240               | Operations Re | esearch         | 2 | 0 | 5 |
| Total HPW Session 1 20 |               |                 |   |   |   |
| Total HPW Session 2    |               | 20              |   |   |   |
| Total Credit F         | oints         | 121             |   |   |   |
|                        |               |                 |   |   |   |

## 3146

## **BE(Civil) BE(Mining) in Civil Engineering and** Mining Engineering – Full-time Course

Students enrol in the Bachelor of Engineering in Civil Engineering Course **3620** which is administered by the School of Civil Engineering. The first three and a half years of the combined degree course are therefore identical to course **3620**. After completing 7 Sessions of this course, students may apply to enter the Bachelor of Engineering in Mining Engineering Course **3146** which is administered by the School of Mines in the Faculty of Applied Science and aim to complete the mining requirements in 3 additional Sessions.

Students considering this option should discuss the above arrangements with the relevant Course Authorities.

# **Graduate Study**

A number of coursework Masters degrees and Graduate Diplomas are available through the Department of Mining Engineering. In addition, the Department offers the research degrees of Doctor of Philosophy PhD in Mining Engineering **1050**, Master of Engineering ME in Mining Engineering **2180** and Master of Science MSc in Mining Engineering **2060**.

## **Course Outlines**

## 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 graduates 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.120 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 120 credit points must still be attained.

#### Entry for Four Year Graduates Non-Mining

| Core subjec | ts                            | СР |
|-------------|-------------------------------|----|
| MINE0130    | Principles of Mining          | 8  |
| MINE1224    | Mining Engineering Technology | 24 |
| MINE1524    | Mining Conservation           | 12 |
| MINE3114    | Mineral Beneficiation         | 12 |
| Project     |                               |    |
| MINE5064    | Minor Project                 | 24 |
| MINE5124    | Project or                    | 46 |
| MINE5184    | Major Project                 | 72 |
|             |                               |    |

# Entry for Graduates in Mining Engineering or from Course 5040

#### **Core subjects**

| MINE5324   | Principles of Mining Engineering (2) | 24 |
|------------|--------------------------------------|----|
| MINE1524   | Mining Conservation (1)              | 12 |
| and either | <b>G</b> ( )                         |    |
| MINE3224   | Mineral Beneficiation Technology or  | 24 |
| MINE4424   | Mineral Industry Analysis            | 10 |
| Project    |                                      |    |
| MINE5064   | Minor Project or                     | 24 |
| MINE5124   | Project or                           | 48 |
| MINE5184   | Major Project or                     | 72 |
| MINE3654   | Minerals Engineering Project         | 36 |
|            |                                      |    |

#### 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

| MINE5655 | Bock Slone Stability                   | 8  |
|----------|--|----|
|          | Subsidence Engineering                 | š  |
|          | Subsidence Engineering                 | 0  |
| MINE9174 | Fire and Explosion                     | 8  |
| GEOL0300 | Computing and Statistics for           |    |
|          | Geologists                             | 12 |
| GEOL0330 | Geostatistical Ore Reserve Estimations | 12 |
| GEOL0390 | Conceptual Models for                  |    |
|          | Exploration Geology                    | 12 |
| MINE0014 | Exploration Drilling                   | 12 |
| MINE1514 | Ground Control and Excavation          |    |
|          | Engineering                            | 12 |
| MINE1534 | Environmental Conditions in Mines      | 12 |
| MINE1544 | Rock Excavation and Transportation     | 12 |
| MINE3514 | Mineral Beneficiation Plant Design     | 12 |
| MINE3634 | Minerals Engineering Laboratory        | 12 |
|          |  |    |

|          |                                       | UP. |
|----------|---------------------------------------|-----|
| MINE4424 | Minerals Industry Analysis            | 12  |
| MINE4055 | Numerical Methods in Geomechanics     | 12  |
| MINE4155 | Stability of Slopes                   | 12  |
| MINE5155 | Rock Mechanics Measurements           | 12  |
| MINE5255 | Strata Control Engineering            | 12  |
| MINE5355 | Mine Fill Technology                  | 12  |
| MINE5455 | Advanced Rock Cutting Technology      | 12  |
| MINE5555 | Blasting Technology                   | 12  |
| MINE9364 | Equilibrium Concepts in Water Systems | 12  |
| MINE9374 | Hydrogeochemistry                     | 12  |
| MINE9415 | Advanced Rock Mechanics               | 12  |
| MINE3224 | Mineral Beneficiation Technology      | 24  |
| MINE3614 | Minerals Engineering 1                | 24  |
| MINE3624 | Minerals Engineering 2                | 24  |
| MINE3644 | Minerals Engineering 3                | 24  |

~ ~

#### 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.

#### 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 120 credit points of undergraduate subjects may be substituted for the topics shown where appropriate to the skills of the student concerned.

| Full-time Pro | ogram                             | СР |
|---------------|-----------------------------------|----|
| MINE0130      | Principles of Mining              | 8  |
| MINE1114      | Mining Engineering                | 24 |
| MINE1224      | Mining Engineering Technology or  | 24 |
| MINE3224      | Mineral Beneficiation Technology  | 24 |
| MINE1324      | Mining Engineering Laboratory and |    |
|               | Project or                        | 32 |
| MINE3324      | Mineral Engineering Laboratory    |    |
|               | and Project                       | 32 |
| MINE3114      | Mineral Beneficiation             | 12 |
| MINE7140      | Mineralogical Assessment          | 4  |
| MINE7341      | Mineral Process Engineering       | 8  |
| 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 24 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**

# **Graduate Study**

## **Course Outlines**

## 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 12 credit points 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 36 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 (12 credit points)

| Science and                                    | rechnology modules (12 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               |  |
| KCME1109                                       | Geophysics for Mine Development          |  |
| KCME1302                                       | Mine Ventilation and Environment         |  |
| KCME2101                                       | Strata Control                           |  |
| KCME2104                                       | Application of Computers in the Mining   |  |
|  | Industry                                 |  |
| KCME2105                                       | Geostatistical Ore Reserve Estimation    |  |
| 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                |  |
| KCME4303                                       | Mine Geology and Grade Control           |  |
| Business Management Modules (12 credit points) |  |  |
| KONEAAOO                                       |  |  |

| Duomeoo ma | ragement medales (12 creat 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 and Project Evaluation                |
| 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           |
|----------|-------------------------------------|
|          | 48 credit points (course 8057 only) |
| KCME1400 | Mining Management Project           |
|          | 36 credit point (course 5057 only)  |
|          |                                     |

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.

#### APSE0002

Social Issues in Applied Science Staff Contact: Department of Applied Geology Office Department of Mining Engineering Office CP5 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.

#### GEOL0004

Special Program Applied Geology Staff Contact: Dr AC Dunlop, Mr GH McNally CP120 Note/s: For programs 8022.1000, 8022.2000 and 8022.3000.

#### GEOL0005

**Research Thesis Applied Geology Full-time** 

Staff Contact: Dr AC Dunlop CP120 Note/s: For programs 1000 and 2000.

#### GEOL0006

**Research Thesis Applied Geology Part-time** 

Staff Contact: Dr AC Dunlop CP60 Note/s: For programs 1000 and 2000

#### GEOL0110

Geological Remote Sensing Staff Contact: A/Prof GR Taylor CP12 S1 L4 HPW3

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: A/Prof GR Taylor CP48 Note/s: Restricted to program 8026.

#### GEOL0300

Computing and Statistics for Geologists Staff Contact: Dr DR Cohen CP12 SS L2 T1

Introduction to the use of PC's, operating systems, communications and networks, common software packages. An introduction to programming, spreadsheets, graphics software and the SYSTAT package. Fundamentals of statistics including types of data, population characterisation, tests of significance, analysis of variance and basic geostatistical methods.

#### GEOL0304

Data Processing Project 1 Staff Contact: A/Prof GR Taylor CP24 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.

#### GEOL0310

Image Processing of Spatial Data Sets Staff Contact: A/Prof GR Taylor CP12 SS L2 T1

Data sources and formats, remotely sensed, geophysical, geochemical and topographic. Image display systems; data pre-processing, image rectification, spatial filtering and enhancement techniques. Statistical analysis, classification and image display as a tool for data integration.

#### GEOL0314

Data Processing Project 2 Staff Contact: A/Prof GR Taylor CP48 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.

#### GEOL0320

#### **Geostatistical Ore Reserve Estimation**

Staff Contact: Key Centre for Mines Office CP12

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.

#### GEOL0330

#### Conceptual Models for Exploration Geology Staff Contact: Dr AC Dunlop

CP12 SS L2 T1

The development and use of ore deposit models as a guide for exploration. Examples drawn from the major categories of deposit such as epithermal gold, greenstone associated gold, vein-type uranium, porphyry coppers, volcanogenic massive sulphides, carbonate and shale-hosted lead-zinc and ultramafic hosted nickel sulphides. Exploration strategies and tactics; risk analysis and prospect evaluation.

## GEOL0340

#### Geochemical Exploration Techniques Staff Contact: Key Centre for Mines Office CP12 SSL2 T1

Regolith development and element mobility. Principles of exploration geochemistry and its role in mineral exploration. Detailed consideration of soil, rock and drainage sampling interpretation techniques. Consideration of appropriate analytical techniques. Problems related to Australian and other regional environments examined on the basis of case histories.

## GEOL0350

#### Exploration Geochemical Data Processing Staff Contact: Dr DR Cohen, Dr AC Dunlop CP12 SS L2 T1

Graphical analysis of exploration geochemical data using boxplot, stem and leaf display and quantile plotting techniques; identification of anomalous observations. Correlation of geochemical variables; principal component analysis and identification of geochemical processes. Regression analysis and adjustment of background populations in geochemical data. Discriminant function analysis and factor analysis. Spatial filtering and definition of geochemical anomalies and regional distribution patterns of elements. Introduction to robust statistical methods. New developments in geochemical data processing. Data visualisation.

## GEOL0360

#### Remote Sensing Applications in Geoscience Staff Contact: A/Prof GR Taylor

CP12 SS L2 T1

The physics of various remote sensing techniques. Consideration of various sources of imagery; Landsat, TM, SPOT, aircraft scanners etc. Spectral properties of rocks, soils and vegetation. Geological applications of visible, infrared, thermal and multi-parameter microwave imagery in resource exploration, tectonic studies, geological hazard recognition and environmental monitoring. Mapping and data integration methodologies.

#### GEOL0370

#### Fundamentals of Exploration Geophysics Staff Contact: Mr D Palmer CP12 SS L2 T1

An introduction to the theory and application of geophysical methods to engineering, environmental, and groundwater studies. The methods covered include gravity, magnetic seismic refraction, shallow seismic reflection, DC electrical resistivity, electromagnetic, transient electromagnetic, radar, and geophysical well logging. Each method is described in terms of the fundamental physical principles, data acquisition and field techniques, data processing and presentation, and quantitative interpretation.

#### GEOL0380

Electrical Methods in Geophysical Exploration Staff Contact: Mr D Palmer CP12 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: A/Prof C R Ward CP12 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.

## GEOL1101

Geological Processes Staff Contact: Dr MD Buck

CP15 S1 L3 T2

Prerequisites: HSC mark range required 2 unit Mathematics 60-100, 2 and 3 unit Mathematics 1-50, or 3 and 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.

The Solar System. Origin of the Earth. The Earth's internal structure. Continental drift and plate tectonics. The origin of igneous, metamorphic and sedimentary rocks. Geological hazards. Geological time and dating. Structural geology, origins of faults and folds. Origins and circulations of oceans and atmosphere.

#### GEOL1201 Geological Environments

Staff Contact: Dr MD Buck CP15 S2 L3 T2

Prerequisites: GEOL1101

**Note/s:** Up to 4 days of fieldwork is a compulsory part of this subject and may be held in the last week of the mid-year recess. Students will incur personal costs. Details will be provided during the first week of the subject.

Fossils, dinosaurs, mammals and man. Evolution of life. Principles of stratigraphy. Air photo interpretation and geological mapping. Economic and energy resources. Environmental geology. Climates and processes of the recent past. Global geophysics. Coastal geology.

#### GEOL2011

#### Mineralogy and Igneous Petrology

Staff Contact: Dr PC Rickwood, A/Prof BJ Hensen CP15 S1 L2 T3

Prerequisite: GEOL1201

**Note/s:** Fieldwork of up to 4 days is a compulsory part of this subject and may be held in the last week of the mid-year recess. Students will incur personal costs. Details will be provided during the first week of the subject.

Mineralogy. Principles of optical crystallography and the use of the transmitted light polarising microscope. Chemical and physical properties of rock forming minerals. Mineral identification. Igneous Petrology. Occurrence, classification and origin of igneous rocks. Fractional crystallisation and differentiation. Partial melting. Simple binary melting diagrams. Igneous petrology relating to plate tectonics. Macroscopic and microscopic examination of rock forming minerals and igneous rocks in the field and the laboratory.

#### GEOL2022

#### Petrology and Structural Geology

Staff Contact: Dr MD Buck, A/Prof BJ Hensen, Dr PG Lennox, A/Prof CR Ward

CP15 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.Details will be provided during the first week of the subject.

Sedimentary Petrology. The influence of transportation, deposition and diagenesis on the composition, texture and structure of detrital sedimentary rocks. The non-clastic sedimentary rocks including phosphates, evaporites; ferruginous and siliceous deposits. Metamorphic Petrology. Origin and classification of metamorphic rocks as an aid in understanding common mineral assemblages. Petrographic studies of common metamorphic rocks. Field studies. Structural Geology. Origin, classification and description of structural elements and analysis of simple fracture systems. Tectonics and tectonic analysis.

#### GEOL2031

## Sedimentology and Palaeontology

Staff Contact: Dr MD Buck, A/Prof AD Albani CP15 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.Details will be provided during the first week of the subject.

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 domains. The facies concept: lateral and vertical relationships between depositional environments and associated lithofacies. Palaeontology. Morphology and geological significance of invertebrates including Foraminifera, Coelenterata, Brachiopoda, Mollusca, Arthropoda, Echinodermata and Protochordata. Introductory paleobotany, ichnology (trace fossils) and biostratigraphy.

## GEOL2041

## Geological Computing

Staff Contact: Dr DR Cohen CP7.5 S1 L2 T1 Prerequisite: GEOL1101

Introduction to the use of PCs, networking with emphasis on geological software. Introduction to programming with statistical applications pertinent to geoscience. Introduction to statistical theory.

#### GEOL2042

Geological Statistics Staff Contact: Dr DR Cohen CP7.5 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 CP15 S1 L2 T1 Prerequisite: GEOL1101 Neta(s: Eicldwork of up to 5

**Note/s:** Fieldwork of up to 5 days is a compulsory part of this subject. Students will incur personal costs.Details will be provided during the first week of the subject.

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 AD Albani, Mr G McNally CP15 S2 L2 T1

Prerequisite: GEOL1101 or GEOL1201

**Note/s:** Fieldwork of up to 5 days is a compulsory part of this subject. Students will incur personal costs. Details will be provided during the first week of this subject.

The geological use of levels, tacheometers and theodolites; instrumental errors and their correction. Precision of angular and distance measurements. Stadia surveying and its application to detailed geological mapping involving both closed and open traverses. Field computations. Map projections, coordinate systems and the Australian Mapping Grid. System transformations. The use of air photos for geological mapping and geomorphological evaluation of the land. Techniques and principles of aerial photography. Photo-interpretation of geological features. Relationships between geology, drainage, soil and vegetation. An introduction to remote sensing.

#### GEOL2072

#### Environmental Geology

Staff Contact: Mr GH McNally, A/Prof AD Albani, Dr J Jankowski CP7.5 S2 L2 T1

Regolith Geology: land degradation, problem soils, engineering geomorphology, geological hazards, earthquakes, land subsidence. Hydrogeology: The hydrological cycle; confined and unconfined groundwater. Hydrological characteristics of rocks and their measurement. Pump tests. Aquifer boundaries. Exploration for groundwater development and monitoring groundwater resources. Groundwater flow tests. Case studies from the Great Artesian Basin and the Murrumbidgee area. Coastal Geology: Properties of sedimentary populations. Sampling practice and analysis of measured data. Geological implications of sediment parameters. Coastal environmental assessment. Shoreline processes. Geological evolution of the inner continental shelf.

#### GEOL2092 Geochemistrv

Staff Contact: Dr DR Cohen CP7.5 S2 L2 T1 Prerequisite: GEOL1201

Basic principles of modern methods of analysis of silicates. Accuracy, precision and quality of geochemical data. Norms. Graphical display of analyses. Geochemical maps and elementary GIS systems. Geochemical classification of elements; basic crystal chemistry. The natural distribution of elements in terrestrial rocks. Heavy metals in unconsolidated sediments. Radiogenic nuclides and their use in dating rocks and minerals. The nature and origin of meteorites and tektites.

#### GEOL3011

Mineralogical Techniques Staff Contact: Dr PC Rickwood CP7.5 S1 L2 T1 Prerequisite: GEOL1201

Principles of X-ray powder diffractometry and the use of X-ray powder cameras and diffractometers. Elementary stereology. Laboratory methods of mineral separation. Mineral characterisation.

#### GEOL3021

Igneous and Metamorphic Processes Staff Contact: A/Prof BJ Hensen

CP15 S1 L2 T1.5

Prerequisite: GEOL2011 and GEOL2022

**Note/s:** Fieldwork of up to 3 days is a compulsory part of this subject. Students will incur personal costs. Details will be provided during the first week of the subject.

Igneous Petrology. Origin of silicate liquids. High pressure and low pressure fractionation. Liquids and fluids. Nature of the upper mantle. The use of trace elements and isotopes as petrogenetic indicators. Practical petrography and literature studies of igneous suites. Field study. Metamorphic Processes. Metamorphic reactions. Isograds. Mineral assemblages as geobarometers and geothermometers. Fluids in metamorphism. Pressure, temperature, time-paths and tectonic setting of metamorphism in the earth's crust. Metamorphic petrology of Australia. Practical macroscopic and microscopic study of metamorphic suites from different tectonic regimes.

#### GEOL3031

#### Stratigraphy and Basin Analysis

Staff Contact: Prof J Roberts CP22.5 S1 L2 T2 Prerequisite: GEOL1201 Note/s: Fieldwork of up to 8 ds

**Note/s:** Fieldwork of up to 8 days is a compulsory part of this subject. Students will incur personal costs.Details will be provided during the first week of the subject.

Stratigraphy. Geological evolution of the Australian continent. Depositional regions within and adjacent to

continents, island arcs and ocean basins. Development of the Pre-Cambrian craton. Palaeozoic-Mesozoic evolution of the eastern Australian mobile belt. Intracratonic basins of western and southern Australia and development of divergent margins. The northern collision zone. Palaeontology. Processes and theories of evolution. Theories of biological classification.

Basin analysis. Basin classification. Data gathering from outcrop and the subsurface. Drilling methods, description of cores and cuttings, petrophysical well logging. Lithofacies analysis, lithofacies maps, palaeocurrents, palaeographic maps. Provenance studies in sedimentary basins. Controls on basin stratigraphy, sea level change, sequence stratigraphy, depositional systems, systems tracts; application of depositional systems to the interpretation of sedimentary basins.

#### GEOL3052

## Exploration Geophysics

Staff Contact: Mr D Palmer CP15 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.Details will be provided during the first week of the subject.

An introduction to the theory and application of geophysical methods to mineral, petroleum, coal, groundwater, and geotechnical studies. The methods covered include gravity, magnetic seismic refraction, shallow seismic reflection, DC electrical resistivity,induced polarization, electromagnetic, transient electromagnetic, radar, and geophysical well logging. Each method is described in terms of the fundamental physical principles, data acquisition and field techniques, data processing and presentation, and quantitative interpretation.

## GEOL3072

Engineering Geology Staff Contact: Mr GH McNally

CP7.5 S2 L2 T1

Intact rock, discontinuities and rock masses; weathering; engineering properties and testing of soils; soil and rock mechanics fundamentals; soil and rock as construction materials; applications of geology in the investigation and design of roads, dams, tunnels and mines.

## GEOL3082

Structural Geology Staff Contact: Dr PG Lennox CP15 S2 L2 T1 Prerequisite: GEOL2022 Note/s: Eieldwork of up to 5

**Note/s:** Fieldwork of up to 5 days is a compulsory part of this subject. Students will incur personal costs. Details will be provided during the first week of the subject.

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 AC Dunlop, Prof GJS Govett, Dr DR Cohen CP7.5 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 AC Dunlop CP15 S1 L3 T2 Prerequisite: GEOL2022 and GEOL2092

**Note/s:** Fieldwork of up to 4 days is a compulsory part of this subject and will be held in the last week of the mid-year recess. Students will incur personal costs. Details will be provided during the first week of the subject.

Geological setting, characteristics and genesis of the major categories of ore deposits. Laboratory study of hand specimens, thin sections and polished sections from these ore deposit categories.

#### GEOL3102

#### Fossil Fuels and Non-metallic Resources

Staff Contact: A/Prof CR Ward, Dr P G Lennox CP15 S2 L3 T2

Prerequisites: GEOL1201

**Note/s:** Fieldwork of up to 3 days is a compulsory part of this subject. Students will incur personal costs.Details will be provided during the first week of the subject.

Coal Geology. Nature and properties of coal. Methods of testing and analysis. Introduction to coal petrology. Origin of coal seams and coal-bearing sequences. Coalfield exploration and coal mining geology. Geological factors in coal preparation and use. 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. Non-metallic Minerals. Occurrences and economic use of non-metallic and industrial minerals including limestone, silica, diatomite and asbestos. Clay Mineralogy. The structure and properties of the clay mineral groups including the kaolinites, illites, smectites, chlorites, mixed layered and fibrous clay minerals. Techniques for the identification of the clay minerals. Clay-water systems and ion exchange. Chemical weathering and the origin of the clay minerals. Industrial uses of clays and bauxite.

#### GEOL4111

#### Advanced Geological Techniques

Staff Contact: Dr PC Rickwood, Dr DR Cohen, A/Prof GR Taylor, A/Prof BJ Hensen

#### CP15 S1 L T6

**Note/s:** Fieldwork of up to 7 days is a compulsory part of this subject. Students will incur personal costs.Details will be provided during the first week of the subject.

Geochemical Techniques. Sampling strategy and methodology; preparation of samples for analysis. Practical usage of modern destructive and non-destructive methods of rock and mineral analysis including AAS, ICP, DCP, and XRF. Geological Data Processing. Application of probability graphs to exploration data. Processing and interpretation of geological data using selected univariate and multivariate statistics; typical case studies in mathematicat 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 AC Dunlop CP15 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; use of geological database and modelling systems; estimation of resources and reserves; reporting requirements, liability and ethics in geological practice. Research and communication: Writing and illustration of scientific reports, theses and papers. Short written reports for editing in class; major report encompassing literature search and description of the thesis topic. Preparation of maps and other illustrations. Presentation of technical material in verbal form.

#### GEOL4131

Special Topics in Applied Geology Staff Contact: Dr PG Lennox CP25 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, GEOL4213, GEOL4303 and GEOL4343) 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 PG Lennox CP60 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.

## GEOL4213

Field Project (P/T) Staff Contact: Dr PG Lennox CP30 S2 HPW10 (Year 1) S2 HPW 10 (Year 2) 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.

#### GEOL5211

#### **Geology for Mining Engineers 1**

Staff Contact: Dr MB Katz CP10 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: Dr PG Lennox CP7.5 S1 L2 T1

**Note/s:** Fieldwork of up to 2 days is a compulsory part of this subject. Students will incur personal costs. This is a servicing subject taught within courses offered by other schools or faculties.

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 plate tectonics. Minerals under the microscope. Microscopic features of sandstone and limestone. Nature and identification of clay minerals. Coal and Petroleum formation; development of sedimentary basins.

#### GEOL5311

### **Geology for Mining Engineers 2**

Staff Contact: Dr MB Katz

#### CP20 F L1 T2

**Note/s:** Fieldwork of up to 1 day is a compulsory part of this subject. Students will incur personal costs. This is a servicing subject taught within courses offered by other schools or faculties.

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: A/Prof CR Ward, Dr PG Lennox CP7.5 S2 L2 T1 Prerequisite: GEOL5301

**Note/s:** This is a servicing subject taught within courses offered by other schools or faculties.

Petroleum Geology: Petroleum generation, including kerogen types and maturation migration, entrapment and degradation; Sedimentary features of reservoir squences; 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 and Geophysics Staff Contact: Dr PG Lennox, Mr D Palmer CP5 S1 L1.5T5 Prerequisite: GEOL5312 Note/s: This is a servicing subject taught within courses offered by other schools or faculties.

Petroleum exploration and development programs; sub-surface maps and sections; geologic characteristics of selected reservoir types: porosity characteristics and recovery effects; estimation of petroleum resources. Interpretation and application of 2D and 3D seismic reflection data. Structural maps, amplitude seisimic velocities, amplitude versus offset and frequency effects. Estimation of petroleum resources.

#### GEOL5410

Geology for Mineral Engineers Staff Contact: A/Prof CR Ward, Dr MB Katz

CP5 S2 L2

**Note/s:** This is a servicing subject taught within courses offered by other schools or faculties.

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.

#### GEOL7321

Geology for Geomorphologists and Pedologists Staff Contact: Dr MD Buck, A/Prof AD Albani

CP15 S1 L1 T1 S2 L2 T2 Prerequisites: GEOL1201

Note/s: This is a servicing subject taught within courses offered by other schools or faculties.

*Clay Mineralogy.* The structure and the properties of the clay groups, including the kaolinites, illites, smectites, chlorites, mixed-layered and fibrous clay minerals. Techniques for the identification of the clay minerals. Clay-water systems and ion exchange. Chemical weathering and the origin of the clay minerals. Industrial uses of clays and bauxite. *Sedimentology.* Properties of sedimentary populations. Sampling practices. Measurement of grain size, grain shape and packing; analysis of measured data. Geological significance of sediment parameters. *Coastal Geology.* The shoreline processes. Littoral and longshore drifts and net sand movement. Coastal engineering works. The estuarine environment; sedimentation, chemical and biological processes, investigation techniques.

#### GEOL9010

#### Groundwater Environments Staff Contact: Dr J Jankowski

CP12 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.

#### GEOL9030

Geological Engineering Staff Contact: Mr GH McNally CP12 S1

Geomechanical properties of intact rock, discontinuities and rock masses. Weathering processes and geotechnical consequences. Mechanical excavation and blasting. Rock support for shallow underground structures. Dam engineering, dam site geology, embankment zoning, foundation treatment and grouting, materials selection and specification. Foundation engineering.

#### GEOL9031

#### Engineering Geology of Surficial Materials

Staff Contact: Mr GH McNally CP12 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 GH McNally CP12 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 benefication; environmental considerations, blast monitoring and quarry reclamation; waste and synthetic materials.

#### GEOL9033

Terrain Evaluation Staff Contact: Mr GH McNally CP12 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: Mr GH McNally

CP12 S1 L1.5 T1.5

**Note/s:** This subject is being revised. Intending students should contact Mr G H McNally.

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 CP12 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 CP12 S2

Note/s: Not offered in 1996.

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 GH McNally CP12 S1 L3

Geology and urban planning; geological input to Environmental Impact Statements; soil and rock construction materials; ground subsidence due to mining and groundwater pumping; geological hazards; land degradation and problem soils; engineering geomorphology.

#### GEOL9070

Engineering Geophysics Staff Contact: Mr D Palmer CP12 S1 L2 T1 Nete/ex Short field tutoriols /

**Note/s:** Short field tutorials are included as part of this subject. Students will incur personal costs.

An introduction to the theory and application of geophysical methods to engineering, environmental, and groundwater studies. The methods covered include gravity, magnetic seismic refraction, shallow seismic reflection, DC electrical resistivity, electromagnetic, transient electromagnetic, radar, and geophysical well logging. Each method is described in terms of the fundamental physical principles, data acquisition and field techniques, data-processing and presentation, quantitative interpretation, and case histories.

#### GEOL9100

#### Remote Sensing of Groundwater Resources Staff Contact: Applied Geology Office CP12 S1 L1.5 T1.5

The physics of various remote sensing techniques; interpretation of conventional aerial photography in exploration; Infrared remote sensing techniques; sidelooking 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.

#### GEOL9110

Hydro and Environmental Geology Staff Contact: Dr I Acworth CP7.5 S2 L2 T1 Prerequisite: GEOL5100 Note/s: This is a servicing subject taught within courses

offered by other schools or faculties.

Hydrogeology: determination of intrinsic permeability in field and laboratory, tracer tests, finite difference modelling methods applied to groundwater flow, drilling methods for unconsolidate and consolidated deposits, piezometer design and installation, remote sensing methods for contaminated groundwater investigations, sampling methods.

Hydrogeochemistry: Chemical composition of natural and contaminated groundwater, inorganic parameters in groundwaters, chemical types of groundwaters, chemical reactions and processes, chemical evolution and chemical classification of groundwaters, chemical equilibrium, disequilibrium, acid-base chemistry, the carbonate system and pH control, oxidation and reduction.

#### GEOL9120

#### Groundwater Contaminant Transport

Staff Contact: Dr J Jankowski CP7.5 S1 L2 T1 Prerequisites: GEOL9110

**Note/s:** This is a servicing subject taught within courses offered by other schools or faculties.

Weathering reactions and geochemical processes, ion exchange, salt sieving and brine development, dryland salinity, fresh water saline water interaction, application of stable and radioactive isotopes in groundwater studies, groundwater microbiology, corrosion and incrustation in groundwater bores, practical field and laboratory measurements, monitoring and sampling of contaminants in groundwater, sources and types of contaminants, groundwater quality and environmental standards, contaminant mass transport in groundwater chemical dispersion, chemical diffusion and retardation, Kd test, hydrogeochemical modelling, physical and empirical models, modelling of subsurface transport, trace metals in groundwater speciation and transport, restoration and clean-up.

#### GEOL9124

Groundwater Project Staff Contact: Dr I Acworth CP36 S2

Study of similar content to GEOL9144 but at a smaller scale.

#### GEOL9144

**Groundwater Research Project** 

Staff Contact: Dr I Acworth

CP48 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 GH McNally CP24

Study of similar content to GEOL9464 but at a much smaller scale.

#### GEOL9454

Project in Engineering Geology Staff Contact: Mr GH McNally CP36

Study of similar content to GEOL9464 but at a smaller scale.

#### GEOL9464

**Project in Engineering Geology** 

Staff Contact: Mr GH McNally CP60

Note/s: students undertaking field work may incur personal costs.

The project is a research investigation of field and laboratory work in any of the disciplines; Engineering Geology, Environmental Geology or Hydrogeology.

## KCME1102

Mine Safety Management Staff Contact: Prof J Cross

CP12

Note/s: Offered by correspondence.

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 CP12

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.

#### KCME1105

#### Slope Stability for Surface Mining Staff Contact: Key Centre for Mines Office CP12

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.

#### KCME1106

#### Soil and Rock Construction Materials Staff Contact: Mr GH McNally CP12

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 and Mining Engineers Staff Contact: Dr DR Cohen

CP12

Introduction to the use of PCs, operating systems, communications and networks, common software packages. An introduction to programming, spreadsheets, graphics software and the SYSTAT package. Fundamentals of statistics including types of data, population characterisation, tests of significance, analysis of variance and basic geostatistical methods.

## KCME1108 Applied Structural Geology Staff Contact: Dr PG Lennox

Introduction to stereographic projection techniques as applied during structural analysis. Integration of mesoscopic folding, foliations and lineations to development of three dimensional models of the geology. Case studies of hydrocarbon plays, mineral deposits and coal mines. Understanding failure in rocks using the Mohr Failure Envelope. The geometry of normal, thrust and strike-slip faults and resulting structural assemblages. Construction and assumptions underlying drawing balanced cross-sections. Regional structural control of mineralisation. Fundamentals, strategies and techniques for structural analysis of cores. Field techniques for structural analysis of cores. Field techniques for structural analysis in multiply deformed terranes and its application in a base metal mine.

#### **KCME1110**

## Geographical Information Systems in Applied Geology

Staff Contact: A/Prof GR Taylor CP12

Introduction to GIS; raster versus vector systems; overview of GIS in geology and geological applications of GIS. Introduction to raster systems; spatial associations and analysis tools; digital terrain modelling; spatial modelling site and route selection. Introduction to vector systems; vector data models and data base systems. Input of spatial data into vector based GIS; building a vector geographical data base. Managing attribute data; data analysis and modelling using a vector based GIS. Cartographic output and data display; TIN and network. Spatial data analysis methods in geology; geological case studies; integration of GIS and Remote Sensing. GIS hardware, GIS organisational and management issues.

#### KCME1300

Mining Management Project Staff Contact: A/Prof GR Taylor

CP48

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 VS Vutukuri CP12

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: Dr MB Katz CP36

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: Key Centre for Mines Office CP12

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: Key Centre for Mines Office

CP12

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: Key Centre for Mines Office CP12

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: Key Centre for Mines Office

CP12

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: Dr AC Partridge CP12

Coal characterisation, principles of separation, materials handling, sampling theory, sampling equipment and practice, screening and communition, 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: Key Centre for Mines Office

CP12

Note/s: Offered by correspondence.

The course 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: Key Centre for Mines Office CP12

Note/s: Offered by correspondence.

The course 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: Key Centre for Mines Office CP12

Note/s: Offered by correspondence.

The course 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: Key Centre for Mines Office CP12

Note/s: Offered by correspondence.

The course 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: Key Centre for Mines Office CP12

Note/s: Offered by correspondence.

The course 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: Key Centre for Mines Office CP12

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: Key Centre for Mines Office

CP12

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: Key Centre for Mines Office CP12

Geological hazards: seismic risk, landslides, subsidence, floods, erosion, volcanic eruptions, discrete and continuous hazards, event return time. Geological resources and their management: types of resources, use and potential environmental conflict, resource economics and policy formulation. Waste disposal and the mineral industry, reclamation and rehabilitation of land used for extractive purposes. Swamp drainage. Geology and urban planning: map preparation, multiple land use principle, aesthetic criteria for landscape evaluation. Environmental impact of dams, roads, explorative land extractive stages of mining, impact statement techniques, case studies. Communication of geological information to technical and non-technical people. Geological legislation for water resources and waste disposal.

## KCME4201

#### Export Marketing for the Mining Industry Staff Contact: Ms J Morgan CP12

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 surveys of overseas markets for mineral products. Factors related to particular mineral commodities. The recognition of export opportunities. Stages in the development of a market strategy. Market decision making under conditions of uncertainty. The relationship between corporate and marketing strategy for mineral products. Value added mineral products and export marketing. Sources of assistance for export marketing.

#### KCME4202

#### Mine and Project Evaluation Staff Contact: Mr EJ Malone

CP12

Topics to be covered in the course include: introduction to accounting, understanding financial statements, financial theory in relation to project evaluation, evaluation techniques, project financing, cost of capital, revenue assumptions, cost assumptions, risk analysis and responses to uncertainty, project optimisation, feasibility studies, institutional and corporate perspectives on project evaluation, introduction to financial modelling, review of cases for financial modelling, practical exercises in financial modelling, intra-project evaluation, comprehensive financial model case study, valuation reports and published assessments. Coal industry topics: coal qualities, marketing and economics. Mineral Industry topics: significance of technical inputs; preliminary investigations and asset determinations, and underground base metal development study.

## KCME4203

Mine Management Staff Contact: Mr SG Gemell CP12

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: Mr EJ Malone

#### CP12

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: Key Centre for Mines Office

CP12

**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; in-house environmental training progams; 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.

#### KCME 4302 Environmental Assessments Staff Contact: Dr D R Cohen CP12

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.

#### **KCME 4303**

Mine Geology and Grade Control Staff Contact: Mr EJ Malone CP12

Sampling theory and sampling techniques relevant to various styles of ore bodies, mining methods and scales of mining; statistical and geostatistical techniques for verifying and manipulating sample analytical data; reserves modelling; grade interpolation; fundamental grade control problems; case histories; computer modelling demonstrations; practical exercises.

## KCME 4304

Mine Geology and Mining Methods Staff Contact: Mr EJ Malone CP12

Review the effects of rock mechanics and mining methods on mining selectivity, optimal mining units, ground control and mining dilution and combined effects of all of these on the appropriate grade control sampling techniques to achieve reliable estimation of minable reserves; the rock mechanics component will enable mine personnel to appreciate the influence of rock mechanics on mining processes and to make use of expert rock mechanics advice; review the theory of rock mechanics, including the behaviour of mined excavations and ground support to control that behaviour; review open pit and underground mining methods for a range of ore body types and ground conditions; case studies.

#### KCME 4305

**Resource Evaluation** Staff Contact: Mr EJ Malone CP12

This subject covers the use of geostatistical techniques to access a mineral resource, the estimation of recoverable reserves, ore and waste selection and grade control. Valuation, financing and feasibility are also considered.

#### MINE0010

Applied Mechanics Staff Contact: Dr JO Watson CP7.5 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.

#### MINE0014

#### Exploration Drilling Staff Contact: Key Centre for Mines Office CP12 S1 or S2 HPW3

Drilling equipment and technology. Deep boring. Selection of drilling methods, drill hole surveys. Development and exploitation of mineral resources. Exercises on mine planning.

#### MINE0110

Staff Contact: Dr JO Watson CP7.5 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; electrical and mechanical methods for measurement of strain; isotopic elasticity.

#### MINE0120

Stress Analysis 2 Staff Contact: Dr JO Watson CP7.5 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 transformation and principal strains in three dimensions; equations of equilibrium in terms of stress; boundary conditions; Navier equations; strain compatibility and the Airy stress function; stress in thick walled tubes under pressure; stresses around circular tunnel; anisotropic elasticity; the equivalent continuum; yield criteria; the stress space; strain hardening and softening; flow rules; viscoplasticity.

#### **MINE0130**

Principles of Mining Staff Contact: Prof FF Roxborough CP8 S1 Ll2

Mining Engineering terminology and definitions. Drilling techniques for production blasting and exploration. Explosives and rock fragmentation processes. Mine development, access to mineral deposits and their exploitation. Surface and underground techniques. Methods of working coal and metalliferous deposits. Methods of ground support. Offshore mining; the ventilation and drainage of mines; mine transport and materials handling. Mine safety engineering.

#### **MINE0210**

Introduction to Mining Engineering Staff Contact: Prof FF Roxborough CP2.5 S2 L1

**Note/s:** Visits to mines and related undertakings are a requirement of this subject.

Mining in Australia. Performance and requirements of mining in relation to the natural environment. Mineral deposits, metallic, non-metallic and fuels. Elements of prospecting and exploration. The geological environment of mining. Basic mining techniques and methods. Mining equipment and services. Mineral benefication. Relevance of the basic science and engineering disciplines to the mining industry.

#### **MINE0410**

Technical Communication Staff Contact: Dr CR Daly CP5 S2 L1 T1

Writing and presentation of reports, resumes. Analysis of experimental data. Presentation of graphs and figures. Oral presentation styles. Communications. Computer graphic presentation packages.

#### **MINE0710**

Computing 1 Staff Contact: Dr CR Daly CP5 S2 L1 T1

Introduction to hardware and operating systems; application software: word processing, spreadsheets, databases. Programming languages. Use of microcomputers for control, monitoring and data acquisition.

#### **MINE1114**

Mining Engineering Staff Contact: Dr VS Vutukuri CP24 F HPW3

1. Surveying methods to quantify mineral resources. Mine development. Explosives. Shaft sinking, tunnelling, excavation methods. 2. Advanced mining systems, parameters for applicability and efficiency of mining

methods, waste disposal. Non-entry methods, in situ mining. Offshore mining methods. Rock mechanics, mechanical behaviour of rocks. The Mining Acts.

#### **MINE1131**

#### **Mining of Metalliferous Deposits**

Staff Contact: Mr D Panich CP7.5 S1 L3 Prerequisites: MINE0210, MINE1420, GEOL5211

Geology, mineralogy and physical characteristics of a mineral deposit. Mineralisation inventory: maps and sections. Determination of reserves. Choice between surface and underground mining: selection criteria. Mining methods in surface and underground operations. Mining sequence. Production planning and scheduling. Equipment selection: systems approach; types of equipment; selection of type, capacity and number. Mining and ancillary operations. Productivity and operating costs. Health and safety. Communications and control. Rehabilitation.

#### MINE1132

Mining of Coal Deposits Staff Contact: Prof JM Galvin CP7.5 S1 L3 Proceeding the MINEC210, MINE

Prerequisites: MINE0210, MINE1420, GEOL5211

Geological factors, physical and mechanical characteristics of the seam, roof and floor. Maps and sections. Determination of reserves. Choice between surface and underground mining methods: selection criteria. Mining methods for surface and underground operations. Impact of surface constraints. Production planning and scheduling. Mining geometrics. Stability and support. Equipment selection: systems approach; types of equipment; selection of type, capacity and number. Mining and ancillary operations. Productivity and operating costs. Health and safety. Communications and control. Rehabilitation.

#### MINE1140

Geotechnical Engineering Staff Contact: Dr VS Vutukuri CP10 F L1 T 1 Prereguisites: MINE1231, MINE1232

Stresses around mine excavations. Control of ground in the vicinity of underground excavations; bord and pillar, longwall and hard rock. Rock support and reinforcement. Theories of support design including pillars, roadway and longwall supports. Monitoring performance of structure. Energy changes accompanying underground mining. Rock bursts. Outbursts. Mining subsidence: characteristics, effects. prediction and control. Rock slopes: failure mechanisms, stability analyses and design. Application of computer techniques for rock mechanics problems. Laboratory experiments.

#### MINE1224

Mining Engineering Technology Staff Contact: Dr VS Vutukuri CP24 F HPW3

1. Mine ventilation contaminants, toxicity of mineral particles and gases, thermodynamics of mine air, network analyses, air conditioning in mines. Mine safety, health, hygiene, noise. 2. Mine lighting, electrical power distribution, generation and reticulation of compressed air. Materials handling. Surface and underground haulage systems, design criteria. Mine drainage. Standards

specifications. **3.** Feasibility studies. Mine design and layout, separation of functions for maximum efficiency; application of analogue and digital computers. Production control, grade control, administration. Resources allocation, finance, labour, equipment. Size and scope of mining company operations. **4.** Mine support. Mining methods employing fill, fill compressibility. Rock and cemented rock fill. Placement of mixed fills. **5.** Rock mechanics. Stress and strain analysis. The mechanics of strata movement and the distribution of pressure around mine workings. Ground control and methods of support in the workings and the waste. Design of mining excavations. Slope stability. **6.** Subsidence phenomena associated with mine workings. Methods of working and design of structures to minimise damage.

#### MINE1231

Rock Mechanics Staff Contact: Dr VS Vutukuri CP10 S2 L2 T2 Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, MINE0120

Rock mass, rock material and discontinuities: Geomechanical properties of discontinuities: orientation, spacing, persistence, roughness, aperture, filling. Rock mass classification. Rock strength and deformability: concepts and definitions, strength tests, deformability tests by static and dynamic methods, influence of time. Strength criteria for isotropic and anisotropic rock material, shear behaviour of discontinuities, behaviour of rock masses containing discontinuities. Pre-mining state of stress and its measurement. Laboratory experiments.

#### **MINE1232**

Soil Mechanics Staff Contact: Dr JO Watson CP5 S2 L1 T1 Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241. 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 JO Watson CP7.5 F L1 T5 Prerequisites: MINE0010, MINE0110, PHYS1002, MATH1032 or MATH1231 or MATH1042 or MATH1241 Corequisite: MATH2001

Fluid mechanics: properties, fluid statics, laminar and turbulent flow. Newtonian and non-Newtonian fluids. Continuity equation, energy equation, momentum equation. Dimensional analysis. Flow measurement. Energy losses in pipelines and open channels. Fluid dynamics of suspensions. Permeability. Thermodynamics: states, processes and properties. Energy of a system: first and second laws of thermodynamics. Reversibility, ideal gas laws, cycles for heat engines, heat pumps, compressors and refrigerators. Psychrometrics. Laboratory experiments.

#### MINE1321 Mine Water and Drainage

Staff Contact: Dr VS Vutukuri CP2.5 S2 L1

Corequisite: MINE1320

Engineering hydrology, sources of mine water, forecasting water inflows, drainage.

#### **MINE1324**

#### Mining Engineering Laboratory Staff Contact: Dr VS Vutukuri CP32 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.

#### MINE1330

#### Bulk Materials Handling and Transport Staff Contact: A/Prof GC Sen CP5 S2 L1.5 T5

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: A/Prof GC Sen CP6 S1 L1 Prerequisite: MINE0210 Note/s: Visits to mines and

**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.

#### MINE1514

#### Ground Control and Excavation Engineering Staff Contact: Dr VS Vutukuri CP12 FHPW3

1. Natural state of stress in rock masses. Effects of geological structures on the stability of mine working. Stresses and rock movements induced by mining operations. Design of mining systems and layout of workings based upon rock mechanics and functional considerations. 2. Principles and design of support systems. Inter-relation of temporary, stabilising and long term support. Support of permanent mining and civil engineering openings. Control of ground in the vicinity of production excavations. 3. Design and construction aspects of open pit slopes and tailing dams. 4. Rock-breaking and drilling methods, penetrability and workability of rocks; fracturing. Nature, occurrence and

prediction of rockbursts. Mechanics of crack propagation and subsidence.

#### **MINE1524**

Mining Conservation Staff Contact: Dr VS Vutukuri CP12 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, stabilising the mined area, socio-economic aspects of mining, rehabilitation costs, government regulations. Examination and evaluation of a current operation.

#### **MINE1530**

Power Supply in Mines Staff Contact: Dr CR Daly CP5 S1 L1 T1 Prerequisites: MINE0310, MINE1320, PHYS2920,

Electric power distribution, mine cables, switchgear. Flame-proofing and intrinsic safety, fault protection, risk analysis. Oil hydraulic power. Components and circuits. Pumps, motors, valves.

#### **MINE1534**

#### Environmental Conditions in Mines Staff Contact: Dr VS Vutukuri CP12 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 VS Vutukuri CP12 S1 or S2 HPW3

Rock fragmentation drilling, blasting large rounds. Loading techniques, shovels, draglines, bucket wheel excavators, dredges, front-end loaders, tractor scrapers. Operating factors, selection procedures, cost estimating. Materials handling, continuous, semi continuous, batch systems, cost analysis.

#### MINE1630

#### Excavation Engineering (Blasting) Staff Contact: A/Prof GC Sen CP5 S1 L2

Percussive, rotary and hydraulic rock drilling equipment: applications and operating principles, maintenance. Drilling methods: in-the-hole hammer, diamond core, overburden, Odex. Theories of rock fragmentation by blasting. Types of explosives and their properties. Various initiation systems. Blasting accessories and their applications. Blast design in various underground and surface mining operations. Blasting hazards and precautionary measures. Protection of structures against blast induced ground vibrations and airblast. Alternatives to conventional explosives.

#### **MINE1631**

#### Excavation Engineering (Machine Mining) Staff Contact: Prof FF Roxborough CP2.5 S2 L1

Principles of coal and rock cutting mechanics. The performance of picks and free rolling cutters. Cutting tool interaction. The design of cutting arrays for machine mining and tunnelling. impact breakage of rock. Cutting tool materials and the effects of wear. Methods of assessing rock cuttability. Exotic methods of rock breakage.

#### MINE1740

#### Mining Legislation Staff Contact: Prof JM Galvin CP5 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 VS Vutukuri CP10 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, mine climate; physiological effects, air cooling power, factors affecting mine climate and control. Ventilation planning: airflow requirements based on pollutant gas, airborne dust and heat.

#### MINE1930

Industrial Training Staff Contact: Dr AC Partridge CP0 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 GC Sen CP5 S1 L2

Scope for tunnels. Geological investigation. Design of tunnels. Tunnelling methods: drilling and blasting; cut and cover; full face and part face boring machine; shield and immersed caisson. Tunnelling in difficult ground. Ground consolidation methods. Lining and support of tunnels. Debris removal, drainage and ventilation during tunnelling operations. Hazards in tunnelling. Shaft sinking methods: conventional; mechanical boring. Ground treatment by chemical injection and freezing methods. Problems in shaft sinking operations and how to resolve them. Economic considerations of every aspect during tunnelling and shaft sinking. A project.

#### MINE2141

Mineral Economics Staff Contact: Mr D Panich CP5 S1 L2 Prerequisites: MINE1131, MINE1132

Commodities. Supply and demand. business cycles. Exchange rates. Metal markets and hedging. Project financing including: Joint Ventures. Types of capital. Company financial statements and reporting requirements. Feasibility studies and mine evaluation. Determination of cut-off grades. Smelter returns. Marketing and sales contracts.

#### **MINE2142**

Mine Planning and Design Staff Contact: Mr D Panich CP15 F L1 T2 Prerequisites: MINE1131, MINE1132 Corequisite: MINE2141

Interpretation of exploration data. Sampling. Estimation of resource and reserves: traditional and geostatistical methods. Mine planning parameters. Mine design. Equipment selection. Productivity. Capital and operating costs. Mine design project.

#### **MINE2240**

Mining Management Staff Contact: Dr CR Daly CP7.5 S2 L2 T1

Approach to management study, management models, responsibilities, planning, decision making, leadership, communications, negotiations, delegation, motivation and case study of industrial relations. Total Quality Management. Maintenance Engineering. Management Information Systems. Occupational Health and Safety.

#### **MINE3040**

Mine Safety Engineering Staff Contact: Dr VS Vutukuri CP7.5 S2 L1.5 T1.5 Prerequisites: MINE 0210, MINE1420

Outburst in coal mines: occurrence, prediction and control. Mine explosions and their control methane, coal dust, sulphide dust. Mine fires and their control open fires, spontaneous combustion of coal and sulphide ores in underground mines, sealing off fires underground, fire fighting, recovery of sealed-off areas. Water in mines: inundations, inrushes, precautions. Radiation in mines: hazards, dosage, radon gas emission and sources, control of radiation. Safety in mines: accidents; types, causes, rates, prevention. Breathing apparatus; types, uses, physiological requirements. Emergency organisation and rescue work. Miners' diseases; prevention and treatment. Noise and its control in mines; properties of vibrations, measurement of sound, effects, sources, control, Illumination in mines; properties of light, light sources, illumination in underground and open cut mines, standards for mine lighting, photometry, design of lighting systems. Laboratory experiments.

#### MINE3041

Hazard and Risk in Mining Staff Contact: Prof J Cross

CP5 S1 L2

Overview of risk management: quantifying risk and acceptable risk. Statistical methods for identifying potential

for loss. Hazard and risk identification methodologies. Causes of accidents. Methods of quantifying risk: consequence modelling, fault trees, event trees. Methods of controlling risk and living with residual risk.

#### MINE3101

Mineral Process Engineering C Staff Contact: Dr AC Partridge CP10 F L1 T1

The necessity for mineral beneficiation. Mineralogical assessment. Comminution, fracture, liberation, size criteria, energy-size relationships, crushing and grinding. Screening and classifying. Fluid dynamics and suspensions. Attrition. Concentration processes: density, electrical, magnetic and other physical methods. Interfacial phenomena. Surfactants. Flotation. Liquid-solid separation: flocculation, thickening, agglomeration, filtration. Materials balances. Laboratory exercises in mineral engineering.

#### MINE3114

Mineral Beneficiation Staff Contact: Dr AC Partridge CP12 S1 or S2 HPW3 Prerequisite: MINE7341 or equivalent

Processing economics: mineral processing and its integration with mining, metallurgical and chemical operations. Principles of roasting, leaching, electrolysis, cementation, solvent extraction and ion exchange. *Particle mechanics:* size, shape, surface area, size distribution functions. Relative and bulk densities. Theory of fracture mechanisms, comminution, energy requirements. Processes of agglomeration. Physical separation methods, electronic sorting, electrostatic and magnetic separation.

#### MINE3140

Computational Methods in Geomechanics Staff Contact: Dr JO Watson CP5 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.

#### MINE3224

#### Mineral Beneficiation Technology Staff Contact: Dr AC Partridge CP24 F HPW4

Prerequisite: MINE3114 or equivalent

1. Fluid mechanics of mineral pulps, free, hindered and zone settling, thickening, classification, hydrocyclones, dewatering, filtration. Gravity concentration jigging, sink and float, flowing film fluidized beds. 2. Interfacial

phenomena, the structure of solid-water, air-water, solid-air and oil-water interfaces. Experimental techniques, applicable to the study of these interfaces. Electrokinetic theory, electrical double layer interaction. Adsorption mechanisms. Collectors, activators, depressants, modifiers, frothers, flocculants. 3. Sulphide mineral flotation, xanthate chemistry, oxide mineral flotation, salt mineral flotation. Coal preparation, coal constitution, bore core evaluation, selective preparation, blending for utilisation. 4. Process design. Feasibility studies, extraction processes and environmental conditions. Selection and location of equipment, fluid-solids flow, design of auxiliary units, development and presentation of flowsheets. Sampling and experimental techniques, batch, continuous and pilot plant testing. Scale up. Product disposal. Principles of chemical analysis, instrumentation, measurement of variables in mineral processing, controllers, use of computers. Technical management.

#### MINE3240

Operations Research Staff Contact: Dr CR Daly CP5 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.

#### **MINE3324**

Mineral Engineering Laboratory Staff Contact: Dr AC Partridge CP32 S1 or S2 HPW3 Prerequisite: MINE3114 or equivalent

Laboratory investigations may be selected from the following according to availability and specialisation: metalliferous ore concentration; coal preparation; beneficiation of non-metallics; processing of mineral fluids.

#### **MINE3514**

Mineral Beneficiation Plant Design Staff Contact: Dr AC Partridge CP12 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 AC Partridge CP24 S1 L3 T4

1. Principles of mineral deposition. Constitution of coal. Fuel technology. Coke making. Principles of extractive metallurgy. Beneficiation and utilisation of industrial minerals. Materials balances. 2. Fluid dynamics of mineral pulps. Rheology of fluids and particulate suspensions. Dynamics of particle and bubble motion and collision. Flow through porous media. Fluidized beds. Flow in pipes, open channels and thin films. 3. Materials handling: Flow characteristics of granular materials. Belt and mechanical conveyors. Stockpiles, bins and hoppers. Blending. Feeders. Distributors. Slurry pumps. Solids pipelines. Sampling theory and practice. **4**. Particle statistics: Concepts of particle size. Size analysis methods. Size distribution functions. Specific surface. Shape factors. Number, Surface and Volume mean sizes. **5**. Interfacial phenomena: Free surface energy. Surface tension. Three phase contact. Electrokinetic theory. Double layer interaction. Chemical and physical adsorption. Experimental techniques. Foams.

#### MINE3624

Minerals Engineering 2 Staff Contact: Dr AC Partridge CP24 S1 L4 T4

1. Comminution. Fracture. Liberation. Energy-size relationships. Grindability. Conventional comminution equipment. Feed and product characteristics. Open and closed circuit operation. Vibratory and fluid energy mills. 2. Screening and classification. Screening as a process of chance. Screen loading. Factors affecting screen capacities. Types of screen. Probability screens. Optical imaging. Hydraulic, mechanical and cyclone classifiers. 3. Physical concentration processes. Gravity concentration. Jigs, heavy media and flowing films. Electronic and optical sorting. Electrical and magnetic separators. 4. Chemical concentration processes. Leaching. Solvent extraction and ion exchange. Cementation. Cyanidation and amalgamation. 5. Flotation. Collectors, activators, depressants, modifiers, frothers. Conventional and novel cells. Flotation kinetics. Entrainment. Soluble salt flotation. Reverse flotation. Agglomeration and carrier flotation. Selective flocculation and agglomeration. 6. Liquid-solid separation and product disposal. Flocculation. Thickening. Filtration. Drainage. Dewatering by screens and cyclones. Centrifuging. Dryers. Tailings dams. Tailing utilisation including mine fill, reclamation. Pollution control.

#### MINE3634

Minerals Engineering Laboratory Staff Contact: Dr AC Partridge CP12 S1 T3

A series of laboratory investigations relating to material covered in subjects MINE3614 and MINE3624

#### **MINE3644**

Minerals Engineering 3 Staff Contact: Dr AC Partridge CP24 S2 L4 T4

1. Process analysis and simulation. Partition and efficiency curves. Washability curves. The Mayer curve. Computer models of comminution, sizing and concentration processes. Laboratory and pilot scale testing. Scale up procedures. 2. Process design. Process appraisal, selection of technology based upon mineral properties, extraction processes, energy requirements and environmental conditions. Feasibility studies. Special considerations for coal preparation and treatment of industrial minerals. Process flowsheet planning, equipment selection and details of solid and fluid flows. Engineering flowsheets showing details of major and auxiliary units, materials handling, product disposal, water and electricity, distribution and equipment control. 3. Instrumentation and control. Principles of chemical analysis. Laboratory and in situ instrumental analysis. Flow and density gauges. Level detectors. Belt weighers. Controllers and control strategies. Automation. 4. *Plant design.* Factors influencing selection of site. Plant and site layout. Preparation of technical and commercial specifications and tender documents. Construction scheduling. Environmental aspects. Noise control. Safety. 5. *Management.* Personnel selection and training. Trade Union organisation. Communications and consultation. Management structure and organisation. Marketing. Contracts and smelter schedules. Maintenance planning. Accounting and budget control. Purchasing and stores policies.

#### **MINE3654**

## Minerals Engineering Project

Staff Contact: Dr AC Partridge CP36 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.

#### MINE4055

#### Numerical Methods in Geomechanics Staff Contact: Dr JO Watson CP12 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 post-processing, elastoplasticity, groundwater flow, modelling strategy, programming considerations. Geotechnical applications. *Boundary Elements:* Basic singular solution, indirect method, direct method, isoparametric and infinite elements, programming considerations, geotechnical applications.

#### **MINE4101**

Mineral Processing Practices Staff Contact: Dr AC Partridge CP5 S1 L2

Prerequisites: MINE3101

Physics and chemistry of surfaces. Measurement of surface properties. On-stream and laboratory analysis and measurements. Laboratory and pilot testing. Flowsheet design. Equipment selection. Plant layout. Monitoring and control systems. Process evaluation. Storage and blending. Materials handling. Waste disposal and pollution control. Waste treatment. Process simulation. Marketing.

#### MINE4140

Minerals Industry Project Staff Contact: Dr AC Partridge CP20 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.

## MINE4155 Stability of Slopes

Staff Contact: Prof J M Galvin CP12 S1 or S2 HPW3

Data collection for pit slope design, statistics of defects in rock masses: Length, orientation, spacing, roughness, planar and two wedge failure modes. Tetrahedral wedges, Bishop, Morgenstern-Price and other methods. Physical admissibility. Toppling and other modes of failure, probabilistic slope analysis, effect of persistence, bench and overall slope design. Slope support; cable bolts, anchors and other methods, drainage for improvement of stability. Dams and tailings disposal. Slope monitoring. Continuum and joint seepage of water.

#### MINE4240

#### Industrial and Research Seminars Staff Contact: Prof FF Roxborough

CP5 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.

#### **MINE4401**

## Mine Waste Disposal and Environment Staff Contact: Dr AC Partridge

CP5 S2 L2

Environmental legislation. Mine waste management, land use relating to the disposal of mine wastes. Construction, maintenance and safety of tailings dams and spoil tips. Groundwater considerations. Spontaneous combustion. Retreatment of mine washes. Rehabilitation and revegetation of waste areas.

#### MINE4424

Mineral Industry Analysis Staff Contact: Dr VS Vutukuri CP10 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, queueing 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.

#### MINE4540

The Mining Engineering Profession in Society Staff Contact: Dr JO Watson CP5 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.

#### MINE4555

Mining Geomechanics Project Staff Contact: Dr JO Watson CP48 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 VS Vutukuri CP24 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 VS Vutukuri CP48 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 VS Vutukuri CP12 S1 or S2 HPW3

Field measurement of rock mass properties. Controlled post-failure strength and deformation properties of rock. Data collection and analysis. *In situ* stress measurement. Prediction of pre-mining rock stresses. Monitoring rock movement and stress change in underground and surface rock excavations. Seismic techniques in rock mechanics.

#### **MINE5184**

Major Project

Staff Contact: Dr VS Vutukuri

CP72 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 VS Vutukuri CP12 S1 or S2 HPW3

Dislocations, stress changes and energy changes in the rock mass around underground excavations. Design of self-supporting, artificially supported and caved underground excavations. Introduction to boundary element methods of stress analysis. Prediction and control of rockbursts and instantaneous outbursts in coal. Analogue modelling of pillar mining. Rock mechanics of longwalls.

#### MINE5324

Principles of Mining Engineering Staff Contact: Dr VS Vutukuri CP24 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: Department Office CP12 S1 or S2 HPW3

Fill properties and their assessment. Fill preparation, placement and dewatering. Field sampling and in situ testing. Mining methods employing fill. Pozzolanic fills. Dry fills and rock fills. Economic aspects of fill practice. Soil and rock mechanics aspects. Environmental aspects. Specific fill practice in mining coal and uranium.

#### MINE5455

Advanced Rock Cutting Technology Staff Contact: Prof FF Roxborough CP12 S1 or S2 HPW3

Mechanics of rock cutting by picks, discs, toothed roller cutters and button cutters. Machine applications. Tool materials and wear. Selection of cutting systems. Rock cuttability assessment. Rock cutting machine design for coal and competent rock. Case studies.

#### MINE5555

Blasting Technology Staff Contact: A/Prof GC Sen CP12 S1 or S2 HPW3

Historical development of commercial explosives. Description of various explosives and their compositions. Explosive properties. Initiation of explosives. Delay systems in firing. Explosive accessories. Handling explosives on site. Safety in firing blasts and precautions against extraneous electricity. Procedure in misfires. Rock blasting without drilling holes. Acquisition, storage and transport of explosives. Underwater blasting. Underwater vibrations from blasting. VCR blasting.

#### MINE5655

Rock Slope Stability Staff Contact: Dr VS Vutukuri CP8 S1 or S2 HPW2

Economic aspects in the design of rock slopes in open cut mines. Failure of rock slopes and controlling factors. Stability of temporary rock slopes. Probabilistic analysis.

#### **MINE5755**

Subsidence Engineering Staff Contact: Dr VS Vutukuri CP8 F HPW2

Trough subsidence resulting from the extraction of bedded mineral deposits. Parameters influencing subsidence. Subsidence-related phenomena causing damage to structures at or below the surface. Measurement and empirical prediction. Theories and modelling of subsidence. Control of subsidence.

#### MINE7342

Minerals Engineering Processes

Staff Contact: Dr AC Partridge CP10 F L1 T1

Objectives of mineral processing and coal preparation. Mine-mill interface. Properties of minerals and ores. Sampling and evaluation. Comminution: fracture, liberation, size criteria, energy-size relationships. Crushing and grinding. Screening and classifying. Concentration processes: density and other physical methods. Dissolution processes. Interfacial phenomena. Flotation. Liquid-solid separation: flocculation, thickening, filtration. Washability curves. Partition curves. Material balances. Performance prediction. Laboratory exercises.

#### **MINE7440**

Mineral Process Technology Staff Contact: Dr AC Partridge CP5 S1 L1.5T5

Feed characterisation: Float-sink separation, release analysis, tree procedure. Vector representation for samples: Mayer curves and release curves. Physics and chemistry of surfaces. Measurement of surface properties. On-stream and laboratory analyses and measurements. Laboratory and pilot testing. Flow-sheet design. Equipment selection and plant layout. Materials handling, storage and blending. Rejects and tailings disposal. Sampling: sampling theory, sources of error in sampling, design of sampling plants. Process optimisation and control.

#### MINE9174 Fire and Explosion

Staff Contact: Dr VS Vutukuri CP8 S1 or S2 L2

Chemistry and physics of combustion reactions; types of flames; deflagration and detonation; ignition; fire point; flammable limits. Industrial fuel-fired appliances; fire risks in buildings; fire fighting equipment; flame proofing; fire and explosive risks in chemical process industries; case studies. Use of appropriate standards and legislation. Fire research; insurance.

#### MINE9364

Equilibrium Concepts in Water Systems Staff Contact: Dr VS Vutukuri CP12 S1 or S2 HPW3

The application and limitations of chemical thermodynamics in water systems. Aqueous inorganic process systems including water treatment and minerals processing. The effects and control of pollution. Thermodynamic diagrams such as InE pH, potential pH, temperature pH and concentration pH are developed as an aid to assessing system energetics. Sources and estimation of thermodynamic data. Kinetics and mechanism in relation to aqueous system energetics. Analysis of kinetic data.

#### MINE9415

Advanced Rock Mechanics Staff Contact: Dr VS Vutukuri CP12 S1 or S2 HPW3

Field measurement of rock mass properties. Controlled post-failure strength and deformation properties of rock. Data collection and analysis of rock mass and support response. In situ stress measurement. Prediction of pre and post-mining rock stresses and deformations. Monitoring rock movement and stress change in underground and surface rock excavations. Seismic techniques in rock mechanics. Dislocations, stress changes and energy changes in the rock mass around underground excavations.

## **Centre for Petroleum Engineering**

#### Director:

Professor WV 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 applying 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 for Petroleum Engineering differs from other Centres as it is responsible for its own degrees and therefore functions as an autonomous Department. It offers both undergraduate and postgraduate research degrees as well as a formal graduate diploma.

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 essentially identical to the first two years of the Chemical Engineering Course. 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.

Because the first two years of the Petroleum Engineering course are identical to the first two years of the Chemical Engineering course, it is possible, upon completion of the Petroleum Engineering program, to obtain a double BE degree in Petroleum and Chemical Engineering with one additional year of study.

## Undergraduate Study: Course Outline

| 3045<br>Petroleum               | Engineering Full-time C      | our    | se   |      |                            |  | HI<br>S1 | PW<br>S2 | СР     |
|---------------------------------|------------------------------|--------|------|------|----------------------------|--|----------|----------|--------|
|                                 | 0 0 -                        |        |      |      | INDC3070                   | Instrumentation and Process                      | ÷ _      |          |        |
| Bachelor of                     | Engineering                  |        |      |      | MATUROOA                   | Control 1  | 0        | 3        | 7.5    |
| BE                              | 0 0                          |        |      |      | MATH3021                   | Mathematics                                      | 2        | 2        | 15     |
|                                 |                              |        |      |      | PTRL3001                   | Reservoir Rock Properties an                     | ď        | _        |        |
|                                 |                              | H      | PW   | CP   |                            | Fluid Flow in Porous Media                       | 2        | 0        | 5      |
|                                 |                              | S1     | S2   | •.   | PTHL3002                   | Rock and Fluid Properties                        | _        | _        |        |
| Voor 1                          |                              |        |      |      |                            | Laboratory                                       | 3        | 0        | 7.5    |
|                                 | Chamiotry 1A                 | ~      | ~    |      | PTRL3003                   | Petroleum Thermodynamics                         | 2        | 0        | 5      |
| CHEMITOT                        | Chemistry 1R                 | 6      | 0    | 15   | PTRL3004                   | Drilling and Production                          | -        | _        |        |
| CHEN1020                        |                              | Ŭ<br>O | 6    | 15   |                            |  | 0        | 3        | 7.5    |
| MATH1131                        | Mathematics 1A or            | 0      | 0    | 30   | PTDL 0007                  | Drilling Fluids and Cementing                    | 0        | 3        | 7.5    |
| MATH1141                        | Higher Methometics 1A        | ~      | ~    |      | PTRL3007                   | Reservoir Engineering 1                          | 0        | 2        | 5      |
| MATH1231                        | Mathematics 1P or            | o      | U    | 15   | PTRL3009                   | Fundamentals of Drilling                         |          | -        | _      |
| MATH1241                        | Higher Mathematics 18        | ~      | 6    | 46   | DTDI 2106                  | Engineering                                      | 2        | 0        | 5      |
| PHYS1002                        | Physics 1                    | e<br>e | 6    | 20   | FIRESTUD                   | Evolution to Formation                           |          | ~        |        |
| General Educ                    | ation subject/s              | 0      | 2    | 75   | DTDI 2107                  | Evaluation<br>Formation Evaluation 1             | 1        | 0        | 2.5    |
|                                 |                              | 0      | 2    | 7.5  | FIREST07                   | Formation Evaluation 1                           | 0        | 3        | 7.5    |
| Total HPW Se<br>Total HPW Se    | ession 1 24<br>ession 2 26   |        |      |      | Total HPW S<br>Total HPW S | ession 1 23<br>ession 2 24                       |          |          |        |
| Total Credit I                  | Points 127.5                 |        |      |      | Total Credit               | Points 122.5                                     |          |          |        |
| Year 2                          |                              |        |      |      | Voor 4                     |  |          |          |        |
| CEIC2010                        | Instrumental Analysis        | 3      | 3    | 15   |                            | Sofety and Environmental                         | ~        | ~        | -      |
| CEIC2020                        | Computing                    | 1      | 2    | 75   |                            | Salety and Environmental<br>Process Dunamics and | 2        | 0        | 5      |
| CEIC2030                        | Applied Thermodynamics       | •      | 2    | 1.5  | 011214070                  | Control  | •        | ~        | 105    |
|                                 | and Bate Processes           | 25     | Δ    | 65   |                            | Design Project                                   | 3        | 2        | 12.5   |
| CEIC2040                        | Applied Electrochemical and  |        | Ŭ    | 0.0  | GEOL 5401                  | Petroloum Production                             | 1        | 2        | 12.5   |
|                                 | Surface Processes            | 15     | 0    | 4    | GLOL3401                   | Goology  | ~        | ~        | ~      |
| CHEN2010                        | Material and Energy Balances | 2      | ž    | 10   | PTRI 4001                  | Beservoir Simulation                             | 2        | 0        | 5      |
| CHEN2020                        | Flow of Fluids               | 2      | 2    | 10   | PTRI 4002                  | Advanced Recovery Mothode                        | 0        | 2        | 5      |
| CHEN2030                        | Heat Transfer                | ō      | 3    | 7.5  | PTRI 4003                  | Well Pressure Testing                            | 2        | 2        | 5<br>E |
| CHEN2040                        | Mass Transfer Fundamentals   | õ      | 2    | 5    | PTRI 4004                  | Advanced Drilling                                | 2        | U        | 5      |
| CHEN2050                        | Chemical Engineering         | -      | -    | -    | 11121004                   | Engineering                                      | 2        | 0        | 75     |
|                                 | Laboratory 1                 | 0      | 2    | 7.5  | PTRI 4016                  | Well Completion and                              | 5        | U        | 7.5    |
| ELEC0807                        | Electrical Engineering1E     | õ      | 3    | 7.5  |                            | Stimulation                                      | 0        | 0        | F      |
| GEOL5301                        | Introduction to Petroleum    | -      | -    |      | PTBL4026                   | Petroleum Production                             | 0        | ٤        | 5      |
|                                 | Geology                      | 3      | 0    | 7.5  |                            | Engineering                                      | 0        | 2        | 5      |
| INDC2050                        | Physical Process Laboratory  | 2      | 0    | 5    | PTRL4007                   | Reservoir Engineering 2                          | õ        | 2        | 5      |
| MATH2021                        | Mathematics 2                | 2      | 2    | 15   | PTRL4018                   | Petroleum Economics 1                            | ž        | ñ        | 5      |
| MATH2819                        | Statistics SA                | 2      | 2    | 10   | PTRL4028                   | Petroleum Economics 2                            | ñ        | 1        | 25     |
| General Educa                   | ation subject/s              | 2      | 2    | 15   | PTRL4105                   | Formation Evaluation 2                           | ž        | 2        | 10     |
| Total HPW Se                    | ssion 1 23                   |        |      |      | PTRL4109                   | Petroleum Engineering                            | -        | -        |        |
| Total HPW Se                    | ssion 2 25                   |        |      |      |                            | Project  | 4        | 2        | 30     |
| Total Credit P                  | ointe 133                    |        |      |      | PTRL4011                   | Communication Skills for                         | •        | -        | 00     |
|                                 | 100                          |        |      |      |                            | Engineers  | 2        | 0        | 5      |
| Year 3                          |                              |        |      |      |                            |  | -        | -        | •      |
| APSE0002                        | Social Issues in Applied     |        |      |      | Total HPW Se               | ession 1 23                                      |          |          |        |
|                                 | Science*                     | 2      | Λ    | 5    | Total Ore dit 5            |  |          |          |        |
| CHEN3040                        | Separation Processes         | 2      | 2    | 10   | rotal Credit F             | roints 125                                       |          |          |        |
| CHEN3061                        | Process Plant Engineering 1  | 4      | â    | 17.5 | The Contro o               | loo offere courses that any st                   |          |          |        |
| CIVL0616                        | Structures                   | 3      | ñ    | 75   | Recentrate En              | so others courses that cover the                 | ιne      | area     | s of   |
| GEOL 5312 Petroleum Geology and |                              |        | , Pr | oduc | TION                       |  |          |          |        |
|                                 | Geophysics                   | ٥      | 3    | 75   | outlines are at            | allable from the Director of the                 | este     |          | urse   |
|                                 |                              | 0      | 0    | 1.5  | outlines are av            | anable norm the Director of the                  | Uer      | itre.    |        |

HPW

S1 S2

CP

## **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 Bachelors 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:

|                | Introduction to Potroloum     |   |   |      |  |
|----------------|-------------------------------|---|---|------|--|
| GEOLSSOT       | Geology                       | 2 | 0 | 125  |  |
| GEOI 5312      | Geology                       | 0 | Ŭ | 12.5 |  |
| acomore        | Accumulations                 | ٥ | 3 | 75   |  |
| PTRI 5001      | Reservoir Bock Properties     | ž | ŏ | 5    |  |
| PTBI 5002      | Bock and Fluid Properties     | 3 | ŏ | 7.5  |  |
| PTRI 5003      | Well Pressure Testing         | 2 | ŏ | 5    |  |
| PTRI 5004      | Reservoir Simulation          | - | Ť | •    |  |
| 111120004      | Fundamentals                  | 0 | 2 | 5    |  |
| PTRI 5005      | Petroleum Thermodynamics      | 2 | ō | 5    |  |
| PTRI 5007      | Reservoir Engineering         | ō | 2 | 5    |  |
| PTRL5008       | Petroleum Production          | • | - | -    |  |
|                | Economics                     | 2 | 0 | 5    |  |
| PTRL5009       | Fundamentals of Drilling      | - | - | -    |  |
|                | Engineering                   | 2 | 0 | 5    |  |
| PTRL5012       | Drilling Fluids and Cementing | 0 | 3 | 7.5  |  |
| PTRL5016       | Well Completion and           |   |   |      |  |
|                | Stimulation                   | 0 | 2 | 5    |  |
| PTRL5026       | Petroleum Production          |   |   |      |  |
|                | Engineering                   | 0 | 2 | 5    |  |
| PTRL5106       | Introduction to Formation     |   |   |      |  |
|                | Evaluation                    | 1 | 0 | 2.5  |  |
| PTRL5107       | Formation Evaluation          | 0 | 3 | 7.5  |  |
| PTRL5109       | Petroleum Engineering         |   |   |      |  |
|                | Project                       | 2 | 2 | 20   |  |
|                |                               |   |   |      |  |
| Total HPW Se   | Total HPW Session 1 19        |   |   |      |  |
| Total HPW Se   | ession 2 19                   |   |   |      |  |
| Total Credit F | oints 110                     |   |   |      |  |

## 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.

## APSE0002

Social Issues in Applied Science Staff Contact: School Office CP5 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: Prof WV Pinczewski CP5 S1 L2

Prerequisites: CHEN2020, MATH2021

Review of rock properties. Measurement of porosity, permeability and compressibility. Capillary tube model for a porous medium. Darcy's law. Steady-state, pseudo-steady state and unsteady state single phase flow. Fluid flow patterns. Well inflow equations. Well PI and skin factor. Ei-function solution for radial diffusivity equation. Constant terminal rate solution for the radial diffusivity equation. Constant terminal pressure solution for the radial diffusivity equation. Principle of superposition. Pressure build-up test for oil wells. Calculation of water influx. Numerical solutions for the radial diffusivity equation.

#### PTRL3002

#### Rock and Fluid Properties Laboratory Staff Contact: A/Prof SS Rahman CP7.5.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: Prof WV Pinczewski CP5 S112 Prereauisite: CEIC2030

Thermodynamic theory for phase behaviour of complex hydrocarbon mixtures at high temperature and pressure. Kinetic theory of gases, theory of liquids and liquid mixtures. Equations of State. Principle of corresponding states. Introduction to commercial phase behaviour and thermodynamic property evaluation packages used in the petroleum industry.

#### PTRL3004

#### Drilling and Production Laboratory Staff Contact: A/Prof SS Rahman CP7 5 S2 T3 Prereauisites: 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: A/Prof SS Rahman CP7.5 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: Adjunct Prof AK Khurana CP7.5 S2 L2 Prereauisite: PTRL3001

Multiphase fluid distribution. Relative permeability and capillary pressure. Capillary-gravity equilibrium. Multiphase flow. Reservoir material balance equations. Calculation of water influx from material balance. Recovery factor and the Buckley-Leverett equation.

#### PTRL3009

Fundamentals of Drilling Engineering Staff Contact: A/Prof SS Rahman CP5 S1 L2

Rotary drilling rig components. Drilling fluid circulating systems. Bottom-hole assemblies, well control and blowout prevention equipment and methods. Special marine equipment. Drilling cost analysis.

#### PTRI 3106

#### Introduction to Formation Evaluation Staff Contact: Dr HA Salisch

CP2 5 S1 L1

Concepts, Data Interpretation, Basic parameters and relationships. Environmental corrections for well logs. Log quality control. General purpose well logs, fluid and formation resistivities

#### PTRI 3107

Formation Evaluation 1 Staff Contact: Dr HA Salisch CP7.5 S213 Prerequisites: PTRL3106. GEOL5301

Formation Resistivities Porosity, lithology, saturation and permeability studies. Movable hydrocarbons. Shalv sand analysis. Wellsite and in-depth computer processed log interpretation. Data integration.

#### PTRL4001

Reservoir Simulation Staff Contact: Adjunct Prof AK Khurana CP5 S2 L2

Prereauisites: PTRL3007, MATH3021

Development of reservoir simulation equations and their solution by finite-difference methods. Standard black oil models and their application to predicting reservoir behaviour. Hands-on use of commercial reservoir simulators: input data preparation, simulator operation, interpretation of simulator output.

#### PTRI 4002

**Advanced Recovery Methods** Staff Contact: Prof WV Pinczewski CP5 S212 Prerequisite: PTRL3007

A comprehensive review of secondary and tertiary oil recovery methods. Secondary water and gas flooding. Mechanisms of miscible and partially miscible displacements of oil and water related to enhanced oil recovery. Influence of phase behaviour on fluid displacement efficiency in surfactants, alcohol, hydrocarbon-miscible, and carbon dioxide flooding processes. Compositional numerical reservoir simulators. Field applications of EOR technologies.

#### PTRL4003

Well Pressure Testing Staff Contact: Prof WV Pinczewski CP5 S1 L2

Prereauisites: PTRL3007, MATH3021

Theory of transient well testing. Practical aspects of design and performance of field tests. Analysis of transient pressure data, effects of boundaries, reservoir heterogeneity, multiphase flow. Study of production, DST and formation interval tests. Pulse testing and multiwell tests. Computer assisted well test analysis techniques.

#### **PTRL4004**

Advanced Drilling Engineering Staff Contact: A/Prof SS Rahman CP7.5 S1 L3

Prerequisites: PTRL3004, PTRL3006, PTRL3009

Drilling methods and elements of rock mechanics. Rotary drill bits. Prediction of formation pore pressure and fracture gradients. Casing design. Directional drilling and deviation control. Coring practices. Fishing operations.

#### PTRL4007

**Reservoir Engineering 2** 

Staff Contact: Adjunct Prof AK Khurana CP5 S2 L2

Prerequisites: PTRL3002, PTRL3003, PTRL3007

Aquifer Modelling. Estimating presence of aquifer and determination of aquifer constants (Qtd solutions). Review of Buckley Leverett theory characteristics and shock fronts. Pattern Floods (5 7 9 spots and line drive). Coning: Chierici solution. Pseudo functions of heterogeneous reservoirs. Hearn/Dykstra-Parsons models. Estimates of reservoir heterogeneity. Dykstra coefficient.

#### PTRL4010

#### Communication Skills and Business Practices for Engineers

Staff Contact: Dr HA Salisch CP5 S1 L2 Prerequisites: All Year 3 subjects.

Communications skills. Preparation of resume. Background research for interviews and guidelines for conduct during interviews. Preparation of written reports and memorandums for maximum audience impact.

Impromptu and prepared oral presentation skills. Business Practices. Key oil industry methods of operation including joint ventures, contracts and relationships with specialist contractors. Role of Engineer in all types of petroleum industry companies including international majors, small domestic producers and service companies. realistic case studies based on industry experience and practices are included in all phases of this subject.

#### **PTRL4016**

Well Completions and Stimulation

Staff Contact: A/Prof SS Rahman CP5 S2 L2

Prerequisites: PTRL3002, PTRL3004, PTRL3009

Reservoir considerations in well completion. Well completion designs. Basic types. Function and operation of subsurface equipment. Perforating. Sand control. Hydraulic fracturing. Acid treatment. Control of formation damage.

#### **PTRL4018**

Petroleum Economics 1 Staff Contact: Dr HA Salisch CP5 S1 L2 Prerequisites; All Year 3 subjects.

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.

#### PTRL4026

Petroleum Production Engineering Staff Contact: A/Prof SS Rahman CP5 S2 L2

Prerequisites: PTRL3002, PTRL3004, PRL3006, 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.

#### PTRL4028

Petroleum Economics 2 Staff Contact: Dr HA Salisch CP2.5 S2 L1 Prerequisite: PTBL4018

Introduction to government legislation and control. Jurisdiction over onshore and offshore petroleum resources. The basic title system. Allocation of permits and licenses. Expenditure commitments. Rental and royalty payments. Pipeline licenses. Discretionary government controls. Aboriginal land rights. Environmental acts and regulations.

#### PTRL4080

Design Project for Petroleum Engineers Staff Contact: Dr HA Salisch CP15 S1 T1 S2 T3 Prerequisites: All Year 3 subjects

The design project covers all aspects of the design of processing facilities for a potentially viable oil/gas field from conceptual design and environmental impact statement preparation through to a detailed design of processing facilities. Major emphasis is placed on the preparation of piping and instrumentation diagrams. Other topics include control schemes, a HAZOP analysis, equipment layout, main power and material requirements, and project schedule and economics.

#### PTRL4105

Formation Evaluation 2 Staff Contact: Dr HA Salisch CP10 F L2 Prerequisites: PTRL3001, PTRL3107

Well logging in complex lithologies. Secondary porosity environment. Special purpose logging. The dipmeter. Formation and fluid sampling. Cementing quality monitoring. Well completions. Gun perforating. Logging in cased holes. Two case studies in Australian oilfields.

#### **PTRL4109**

#### **Petroleum Engineering Project**

Staff Contact: Dr HA Salisch CP30 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.

#### PTRL5001

## Reservoir Rock Properties and Fluid Flow in Porous Media

Staff Contact: Prof WV Pinczewski CP5 S1 L2

Review of rock properties. Measurement of porosity, permeability and compressibility. Capillary tube model for a porous medium. Darcy's law. Steady-state, pseudosteady state and unsteady state single phase flow. Fluid flow patterns. Well inflow equations. Well PI and skin factor. Ei-function solution for radial diffusivity equation. Constant terminal rate solution for the radial diffusivity equation. Constant terminal pressure solution for the radial diffusivity equation. Principal of superposition. Pressure build-up test for oil wells. Calculation of water influx. Numerical solutions for the radial diffusivity equation.

#### PTRL5002

### **Rock and Fluid Properties Laboratory**

Staff Contact: A/Prof SS Rahman

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 HA Salisch CP5 S1 L2

Theory of transient well testing. Practical aspects of design and performance of field test instrumentation. Pressure build-up tests. Pressure drawdown tests. Fall-off tests. Multi-rate tests. Gas well testing. Flow-after-flow. Isochronal and isochronal modified. Interference testing. Pulse testing. Drill stem tests. Fractured reservoir tests.

#### PTRL5004

#### Reservoir Simulation Fundamentals Staff Contact: Prof AK Khurana

CP5 S2 L2

Formulation of reservoir simulation equations. Explicit and implicit solution procedures. Cartesian and radial geometry. Single dimensional, two-phase flow. Description and use of commercial reservoir simulation software. Planning and execution of reservoir simulation projects. Effective use of reservoir simulation as a management and development tool.

#### **PTRL5005**

Petroleum Thermodynamics Staff Contact: Prof WV Pinczewski CP5 S1 L2

Thermodynamic theory for phase behaviour of complex hydrocarbon mixtures at high temperature and pressure. Kinetic theory of gases, theory of liquids and liquid mixtures. Equations of State. Principle of corresponding states. Introduction to commercial phase behaviour and thermodynamic property evaluation packages used in the petroleum industry and calculation of oil formation volume factors and dissolved gas ratios.

#### **PTRL5007**

Reservoir Engineering

Staff Contact: Prof AK Khurana CP5 S2 L2

Basics of phase behaviour, equation of state modelling of gas-liquid systems, reservoir material balances. Identification of major recovery drive mechanisms. Water influx calculations. Well productivity.

#### **PTRL5008**

Petroleum Production Economics Staff Contact: Mr WG Allinson CP5 S1 L2

Need for economic reservoir analysis. Cash flow. Time value of money. Profitability of a venture. Valuation of oil and gas properties. Analysis of risk and uncertainty.

#### PTRL5009

## Fundamentals of Drilling Engineering

Staff Contact: A/Prof SS Rahman CP5 S1 L2

Rotary drilling rig components. Drilling fluid circulating system. Bottom-hole assemblies, well control and blowout prevention equipment and methods. Special marine equipment and drilling cost analysis.

#### PTRL5012

## **Drilling Fluids and Cementing**

Staff Contact: A/Prof SS Rahman CP7.5 S2 L3

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.

#### PTRL5016

Well Completion and Stimulation Staff Contact: A/Prof SS Rahman CP5 S2 L2

Reservoir considerations in well completion. Well completion designs. Basic types. Function and operation of subsurface equipment. Perforating. Sand control. Hydraulic fracturing. Acid treatment. Control of formation damage.

### PTRL5106

Introduction to Formation Evaluation Staff Contact: Dr HA Salisch CP2.5 S1 L1

Concepts Data Integration Review of basic reservoir characteristics. Petrophysical parameters and relationships. Log quality control. The SP measurement. Gamma ray logs. Fluid resistivities.

#### PTRL5107

Formation Evaluation Staff Contact: Dr HA Salisch CP7.5 S2 L3

Formation Resistivities Porosity, lithology saturation and permeability studies. Movable hydrocarbons. Shaly sand analysis. Well site and in-depth computer processed log interpretation. Data integration.

### PTRL5109

Petroleum Engineering Project CP20 S1 L2 S2 L2

A literature survey of a topic of relevance to the research effort of the Centre and of practical interest to the oil industry. To be submitted as an individual thesis. Topic must be approved by the Director of the Centre.

# **Department of Safety Science**

Head of Department Professor Jean Cross

#### Administrative Assistant

Mrs Barbara Littlewood

Safety Science is a multidisciplinary activity concerned with the application of engineering principles and 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:

- Master of Safety Science 8671
- Master of Applied Science (Occupational Health Safety) 8044
- Master of Applied Science (Ergonomics) 8075
- Master of Applied Science (Industrial Safety) 8077
- Master of Engineering Science (Industrial Safety) 8545
- Graduate Diploma in Safety Science 5480
- Graduate Diploma in Ergonomics 5485
- Graduate Certificate in Safety Science 7040
- Graduate Diploma Qualifying Course 6347 which allows non-graduates 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 also administers the Environmental Studies Courses,

- Master of Environmental Studies 8045
- Graduate Diploma in Environmental Studies 5488

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
- Doctor of Philosophy 1665.

## **Graduate Study**

## **Course Outlines**

## **Master of Applied Science Courses**

Admission to the Master of Applied Science courses in the Department of Safety Science is available to candidates with a relevant degree of bachelor for four full-time years duration (or part-time equivalent) from the University of New South Wales or a qualification considered to be equivalent from another university or tertiary institution.

Candidates with a three year degree may be admitted to the Masters program if they are able to demonstrate at least two years experience in a relevant area or may be admitted first to a Graduate Diploma but can upgrade on satisfactory performance.

Other candidates with extensive experience in a relevant area may also be admitted at the discretion of the Head of School.

## 8044 Master of Applied Science (Occupational Health and Safety)

#### MAppSc (OHS)

The Master of Applied Science in Occupational Health and Safety is a multidisciplinary course, and is designed to accept students from a range of backgrounds. The course is offered either full-time or part-time. Students may enrol either as internally registered students (by attendance) or externally registered students (by open learning).

The normal duration is 3 sessions full-time or 6 sessions part-time. However, students who are granted advanced standing in the preliminary subjects may be able to complete the course in one calendar year by completing the project in the summer recess.

Candidates are required to complete a total of 180 credit points, made up of 36 credit points of preliminary subjects, 60 credit points of core subjects,48 credit points of elective subjects and a 36 credit point research project.

#### **Preliminary subjects**

Preliminary subjects are designed to provide a common base of knowledge for students from diverse backgrounds. Students who have studied equivalent subjects in their undergraduate courses or who are able to demonstrate a satisfactory standard of understanding are given advanced standing in these subjects.

| ANAT6151 | Introductory Functional Anatomy  | 12 |
|----------|----------------------------------|----|
| SAFE9011 | Physical Principles of Safety    | 12 |
| SAFE9012 | Statistics for Health and Safety |    |
|          | Scientists                       | 12 |
|          |                                  |    |

~ ~

#### **Core subjects**

There are 60 credit points of core subjects required. Four core subjects are required to be taken by all students, the

fifth core subject is dependent on subsequent areas of study.

00

|          |                                      | UF |
|----------|--------------------------------------|----|
| SAFE9211 | Introduction to Safety Engineering   | 12 |
| SAFE9242 | Effective Behaviour in Organisations | 12 |
| SAFE9260 | Introduction to Occupational Health  | 12 |
| SAFE9210 | Research Methods                     | 12 |
| and      |                                      |    |
| SAFE9261 | Occupational Hygiene or              | 12 |
| SAFE9262 | Occupational Medicine or             | 12 |
| SAFE9263 | Chemical Safety and Toxicology or    | 12 |
| SAFE9224 | Principles of Ergonomics             | 12 |

Students leaving the course should have knowledge and competencies in a number of areas which are reflected in the choice of core subjects.

- occupational health and safety principles
- occupational health and safety legislation and standards
- the interaction between people, hazards, risks and behaviour
- ability to undertake workplace surveys in their chosen fields of expertise.

#### Elective subjects

There are 48 credit points of elective subjects required. Students may structure their program so that they receive training as an occupational health and safety generalist, or they are able to specialise, taking electives in one of a number of strands, such as occupational hygiene, safety engineering, chemical safety, occupational medicine, ergonomics or safety management.

Subjects offered by the Department of Safety Science Not all elective subjects are offered every year.

| BIOM9541 | Mechanics of the Human Body         | 12 |
|----------|-------------------------------------|----|
| SAFE9142 | Organisational Communication        | 12 |
|          | for Safety                          |    |
| SAFE9224 | Principles of Ergonomics            | 12 |
| SAFE9232 | Introduction to Occupational Health |    |
|          | and Safety Law                      | 12 |
| SAFE9261 | Occupational Hygiene                | 12 |
| SAFE9262 | Occupational Medicine               | 12 |
| SAFE9263 | Chemical Safety and Toxicology      | 12 |
| SAFE9264 | Assessment of the Workplace         |    |
|          | Environment                         | 12 |
| SAFE9265 | Occupational Health Practice        | 12 |
| SAFE9267 | Research Methods in                 |    |
|          | Laboratory Science                  | 12 |
| SAFE9272 | Environment and Medicine            | 12 |
| SAFE9273 | Environment and Law                 | 12 |
|          |                                     |    |

| SAFE9343 | Innovation, Productivity and Safety | 12 |
|----------|-------------------------------------|----|
| SAFE9350 | Risk Management                     | 12 |
| SAFE9424 | Applied Ergonomics                  | 12 |
| SAFE9425 | Physical Ergonomics                 | 12 |
| SAFE9426 | Ergonomics and New Technology       | 12 |
| SAFE9523 | Plant and Construction Safety       | 12 |
| SAFE9531 | Industrial and Environmental Noise  | 12 |
| SAFE9543 | Management of Dangerous Materials   | 12 |
| SAFE9544 | Traffic Safety                      | 12 |
| SAFE9551 | Experimental Biomechanics           | 12 |
| SAFE9553 | Radiation Protection                | 12 |
| SAFE9573 | Fire and Explosion                  | 12 |

### Subjects offered by other Departments

Students may also choose to take subjects offered by other Departments, subject to the approval of both the School concerned and the Course Coordinator. Examples of acceptable subjects in a study program in occupational health and safety include:

| Safety in Laboratories                 | 4   |
|--|---|
| Solid Waste Management                 | 12  |
| Hazardous Waste Management             | 12  |
| Disability                             | 10  |
| Tobacco, Alcohol and Other Drug        |   |
| Issues                                 | 10  |
| Community Genetics                     | 10  |
| Population, Health and the Environment | 12  |
| Epidemiology                           | 15  |
| Public Health                          | 15  |
| Occupational Safety and Health Law     | 15  |
| Industrial Management                  | 12  |
| Total Quality Management               | 12  |
| Program Evaluation and Planned         |   |
| Change                                 | 10  |
| Planning, Conducting and Evaluating    |   |
| Educational Workshops                  | 10  |
|  | Safety in Laboratories<br>Solid Waste Management<br>Hazardous Waste Management<br>Disability<br>Tobacco, Alcohol and Other Drug<br>Issues<br>Community Genetics<br>Population, Health and the Environment<br>Epidemiology<br>Public Health<br>Occupational Safety and Health Law<br>Industrial Management<br>Total Quality Management<br>Program Evaluation and Planned<br>Change<br>Planning, Conducting and Evaluating<br>Educational Workshops |

#### Project

Students are required to undertake an investigative project and to present a satisfactory report. The project will normally be of 36 credit points value (SAFE9609). Projects may be based on studies carried out at a student's 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 three such seminars in each session.

Shorter projects are also available in some circumstances.

| SAFE9601 | Report | 4  |
|----------|--------|----|
| SAFE9602 | Report | 8  |
| SAFE9603 | Report | 12 |
| SAFE9606 | Report | 24 |

CP

## Master of Applied Science (Ergonomics)

#### MAppSc

8075

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.

The course is offered full-time or part-time. The normal duration is 3 sessions full-time or 6 sessions part-time. However, students with advanced standing in preliminary subjects may complete the course in one calendar year of full-time study by completing the project in the summer recess.

Candidates are required to complete a total of 180 credit points, made up of 36 credit points of preliminary subjects, 84 credit points of compulsory core subjects, 24 credit points of elective subjects and a 36 credit point Project. For candidates with previous ergonomics qualifications a 72 credit point Project may be undertaken in place of 24 credit points of subjects.

#### Preliminary subjects

SAFE9551

Preliminary subjects are designed to provide a common base of knowledge for students from diverse backgrounds. Students who have studied equivalent subjects in their undergraduate courses or who are able to demonstrate a satisfactory standard of understanding are given advanced standing in these subjects.

|              |                                      | CP |
|--------------|--------------------------------------|----|
| ANAT6151     | Introductory Functional Anatomy      | 12 |
| SAFE9011     | Principles of Engineering Mechanic   | 12 |
| SAFE9012     | Statistics for Health and Safety     |    |
| 041 20012    | Scientists                           | 12 |
|              | Colormoto                            |    |
| Core subject | ts                                   |    |
| SAFE9210     | Research Methods                     | 12 |
| SAFE9224     | Principles of Ergonomics             | 12 |
| SAFE9242     | Effective Behaviour in Organisations | 12 |
| SAFE9264     | Assessment of the Workplace          |    |
|              | Environment                          | 12 |
| SAFE9424     | Applied Ergonomics                   | 12 |
| SAFE9425     | Physical Ergonomics                  | 12 |
| SAFE9426     | Ergonomics and New Technology        | 12 |
| -            | -                                    |    |
| Elective sub | ojects                               |    |
| BIOM9541     | Mechanics of the Human Body          | 12 |
| SAFE9211     | Introduction to Safety Engineering   | 12 |
| SAFE9232     | Introduction to Occupational Health  |    |
| ••••         | and Safety Law                       | 12 |
| SAFE9260     | Introduction to Occupational Health  | 12 |
| SAFE9343     | Innovation, Productivity and Safety  | 12 |
| SAFE9350     | Risk Management                      | 12 |
| SAFE9523     | Plant and Construction Safety        | 12 |
| SAFE9544     | Traffic Safety                       | 12 |
|              |                                      |    |

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.

**Experimental Biomechanics** 

12

#### 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 36 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 72 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.

## 8077 Master of Applied Science (Industrial Safety)

#### MAppSc

This course is designed as a specialist course which builds on a previous four year degree. It is suitable for people who manage safety as part of their line management role and wish to extend their learning in their base discipline in addition to gaining a grounding in Safety. It is also suitable for people looking for a specialist safety course building on a first degree. The course has a core of only three subjects and a very wide choice of elective subjects to suit students from widely varying backgrounds. No preliminary subjects are required for this course as the specialist area chosen must be based on the discipline of a students first degree.

Entry to the Master of Applied Science (Industrial Safety) course requires a four year degree in an approved discipline.

The Master of Applied Science degree is obtained by satisfactory completion of 120 credit points of study, 24 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 credit points to ensure that the prerequisite background held is adequate for all subjects including those taken in other schools or institutions.

Students undertake 36 credit points of compulsory subjects, and 60 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 focus on subjects relating to occupational health safety and management.

#### Core subjects

|          |                                      | <b>.</b> |
|----------|--------------------------------------|----------|
| SAFE9211 | Introduction to Safety Engineering   | 12       |
| SAFE9242 | Effective Behaviour in Organisations | 12       |
| SAFE9350 | Risk Management                      | 12       |
| SAFE9606 | Project                              | 24       |

CD

#### Electives

Students may choose postgraduate electives either from the Master of Safety Science course or from other schools in the University, which have been approved and are detailed in the MASTER OF SAFETY SCIENCE section of this brochure. A full list of all subjects from other schools can be obtained from the various faculty handbooks but approval to take such subjects must be given by both the School concerned and the Course Coordinator. Not all elective subjects are offered every year.

#### Project

Students must undertake an investigative project of 24 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.

## 8671 Master of Safety Science

#### MSafetySc

Candidates are required to complete a program totalling 180 credit points made up of 84 credit points of compulsory subjects, 60 credit points of electives and a 36 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 180 credit point program. 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 |   | CP  |
|----------------------|---|-----|
| ANAT6151             | Introductory Functional Anatomy                                   | 7.5 |
| SAFE9011<br>SAFE9012 | Physical Principles of Safety<br>Statistics for Health and Safety | 12  |
|                      | Scientists  | 12  |

#### **Core subjects**

Core subjects, totalling 84 credit points, represent the central theme of Safety Science and are compulsory.

| SAFE9210 | Research Methods                     | 12 |
|----------|--------------------------------------|----|
| SAFE9260 | Introduction to Occupational Health  | 12 |
| SAFE9211 | Introduction to Safety Engineering   | 12 |
| SAFE9224 | Principles of Ergonomics             | 12 |
| SAFE9232 | Introduction to Occupational         |    |
|          | Health and Safety Law                | 12 |
| SAFE9242 | Effective Behaviour in Organisations | 12 |
| SAFE9350 | Risk Management                      | 12 |
|          | genera                               |    |

#### Electives

Students are required to take at least 60 credit points from the list of electives for the Master of Applied Science (OHS) 8044.

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. A selection of approved subjects is shown in the list of electives for the Master of Applied Science (OHS) 8044.

#### Project

Project Students are required to undertake an investigative project and to present a satisfactory report. The project will normally be of 36 credit points value (SAFE9609). In special circumstances, for example when a student enters the course with substantial prior knowledge in the coursework, a superior Project Report of 72 credit points value (SAFE9618) may be permitted. Projects may be based on studies carried out at a student's 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 three such seminars in each Session.

## **Graduate Diploma Courses**

Graduate Diploma courses in the Department of Safety Science consists of 72 credit points of compulsory core subjects, 24 credit points of elective subjects and 36 credit points of preliminary subjects. Students may be given advanced standing in preliminary subjects, if they have completed equivalent subjects in their undergraduate course or can demonstrate a satisfactory level of understanding of the subjects. Most students will need to complete two preliminary subjects and hence 120 credit points to complete the course.

The course is offered full-time or part-time and requires 3 sessions of full-time study or 6 session part-time after completion of preliminary subjects.

#### **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 Physical Principles of Safety. 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.

## 5480 Graduate Diploma in Safety Science

## GradDip

| Preliminary subjects |                                 | CP |
|----------------------|---------------------------------|----|
| ANAT6151             | Introductory Functional Anatomy | 12 |
| SAFE9011             | Physical Principles of Safety   | 12 |
| SAFE9012             | Statistics for Health and       |    |
|                      | Safety Scientists               | 12 |

#### **Core subjects**

Core subjects, totalling 72 credit points, represent the central theme of safety science and are compulsory.

| Introduction to Safety Engineering<br>Principles of Ergonomics | 12<br>12  |
|--|---|
| Introduction to Occupational Health                            |   |
| and Safety Law   | 12  |
| Effective Behaviour in Organisations                           | 12  |
| Introduction to Occupational Health                            | 12  |
| Risk Management  | 12  |
|  | Introduction to Safety Engineering<br>Principles of Ergonomics<br>Introduction to Occupational Health<br>and Safety Law<br>Effective Behaviour in Organisations<br>Introduction to Occupational Health<br>Risk Management |

#### Elective subjects

Students are required to select two or more subjects from the list of electives or core subjects presented for the MSafetySc program. In special cases a 12 credit point Report in Safety Science SAFE9603 may be taken.

## 5485 Graduate Diploma in Ergonomics

## GradDip

The Graduate Diploma in Ergonomics is multidisciplinary 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.

| Preliminary subjects |                                      | СР  |
|----------------------|--------------------------------------|-----|
| ANAT6151             | Introductory Functional Anatomy      | 7.5 |
| SAFE9011             | Physical Principles of Safety        | 12  |
| SAFE9012             | Statistics for Health and Safety     |     |
|                      | Scientists                           | 12  |
| Core subjects        | 8                                    |     |
| SAFE9224             | Principles of Ergonomics             | 12  |
| SAFE9242             | Effective Behaviour in Organisations | 12  |
| SAFE9424             | Applied Ergonomics                   | 12  |
| SAFE9425             | Physical Ergonomics                  | 12  |
| SAFE9426             | Ergonomics and New Technology        | 12  |

### **Elective subjects**

To complete the requisite total of 96 credit points, students are required to select one or more subjects from the list of Electives presented for the MAppSc (Ergonomics). In special cases a 3 credit point Report in Safety Science SAFE9603 may be taken which must involve the solution of a practical ergonomics problem.

## 7340

## Graduate Certificate in Safety Science\*

The Graduate Certificate provides recognition to students who are limited to study for one session full time or one year part time. The course provides a general introduction to safety science and is suitable as an introductory course for safety professionals or as a course in safety science for people who manage safety as part of their other roles within an organisation.

The Graduate Certificate is available full time (1 session) or part time (2 sessions) in internal or external mode. External students may be required to attend at least one residential course of 2-3 days duration.

Candidates are required to complete 48 credit points of compulsory core subject and 12 credit points of electives selected from the core and elective subjects of the Graduate Diploma and Masters courses offered by the Department.

#### **Core subjects**

| SAFE9211 | Introduction to Safety Engineering   | 12 |
|----------|--------------------------------------|----|
| SAFE9242 | Effective Behaviour in Organisations | 12 |
| SAFE9260 | Introduction to Occupational Health  | 12 |

#### Electives

Elective subjects are listed in the Master of Safety Science (OHS).

No advanced standing will be granted for the Graduate Certificate. Where students have previously studied material equivalent to one of the core subjects exemption may be granted and an additional elective selected.

\*Subject to UNSW Council approval

## **Environmental Studies Courses**

#### 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 and covers a model of environmental studies as an interactive process of three overlapping headings:

- an understanding of natural systems and processes at global, regional and local levels, and the technical assessment and measurement tools for understanding them;
- an appreciation of how human activities impact on the environment (environment as a resource, environmental change, pollution, effects on health, recreational use of the environment) and the methodologies for examining this impact (environmental impact assessment techniques, systems approaches and so on);
- the social context of the environment and human responses to environmental issues (philosophy, ethics, values and ideology, economics, decision making,

policy, environmental planning and management, law and politics).

The UNSW Masters Program in Environmental Studies is designed to provide students and graduates with:

- A conceptual framework for the study of environmental issues and problems, including:
- an understanding of natural systems and processes;
- an appreciation of how human activities impact on the environment;
- the ways in which these areas interact, including understanding of scientific, social, philosophical, economic, ethical, legislative and political concepts. Knowledge and skills in a range of environmental subject areas, including environmental assessment, environmental planning, environmentally oriented decision-making and the ways in which various disciplines may be integrated together.
- Experience in the design and conduct of projects in environmental studies.

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.

#### **Entry qualifications**

CP

The entry qualification for the Master of Environmental Studies degree is a 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. In the past, the course has attracted students from a wide variety of backgrounds, including those with first degrees in geography, biological sciences, geology, ecology, civil engineering, chemistry, physics, law, health administration, agriculture, social science and archaeology.

#### **Course requirements**

Students enrolled on the Master of Environmental Studies Program are required to complete a course totalling 120 credit points made up of compulsory Core Subjects (24 credit points), Elective Subjects (48 credit points) and a Project (48 credit points). 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 coordinators if they are in doubt as to whether they are qualified to take a subject.

There is a very wide range of subjects offered by Schools across the entire University which are suitable for inclusion in the Master of Environmental Studies 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. The Elective Subjects listed below are not exhaustive, and students may choose elective studies

CP

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.

| Core subjects |                                     | СР |
|---------------|-------------------------------------|----|
| SAFE9271      | Environmental Planning and          |    |
|               | Assessment                          | 8  |
| SAFE9272      | Environment and Medicine            | 12 |
| SAFE9273      | Environment and Law                 | 12 |
| SAFE9612      | Project (Environmental Studies) or  | 48 |
| SAFE9606      | Project (Environmental Studies)     | 24 |
| Possible elec | tive subjects                       | ~~ |
| BIOT7081      | Environmental Biotechnology         | 20 |
| CEIC5630      | Industrial water and wastewater     | 10 |
| 0115113005    | Engineering                         | 12 |
| CHEIM/325     | Public Health                       | 28 |
| CIVI 4306     | Engineering and the Environment     | 10 |
| CIVI 9402     | Transport, Environment, Community   | 24 |
| CIVL9403      | Theory of Land Use Transportation   |    |
|               | Interaction                         | 12 |
| CIVL9405      | Urban Transport Planning Practice   | 12 |
| CIVL9408      | Transport Systems Design (Urban)    | 12 |
| CIVL9710      | Engineering Risk Management         |    |
| CIVL9788      | Site Investigations                 | 12 |
| CIVL9790      | Slope Instability                   | 12 |
| CIVL9799      | Environmental Geomechanics          | 12 |
| CIVL9851      | Unit Operations in Public Health    | 40 |
| 01/1 0055     | Engineering                         | 12 |
| CIVL9855      | water and wastewater Analysis       | 12 |
| CIV/I 0956    | and Quality Requirements            | 12 |
| CIVL9050      | Water Treatment and Disposal        | 12 |
| CIVI 9858     | Water Quality Management            | 12 |
| CIVI 9859     | Environmental Hydrology             | 12 |
| CIVL9860      | Investigation of Groundwater        |    |
|               | Resources                           | 12 |
| CIVL9861      | Environmental and Engineering       |    |
|               | Geophysics                          | 12 |
| CIVL9862      | Fluvial Hydraulics                  | 12 |
| CIVL9872      | Solid Waste Management              | 12 |
| CIVL9875      | Hydrological Processes              | 12 |
| CIVL9876      | Water Resource Modelling            | 12 |
| CIVL9880      | Groundwater Modelling               | 12 |
| CIVL9881      | Finite Province Province Science 1  | 12 |
| CIVL9004      | Environmental Engineering Science 2 | 12 |
| CIVL9888      | Environmental Management            | 12 |
| CIVI 9889     | Environmental Economics and Law     | 12 |
| CIVI 9891     | Groundwater Contamination and       |    |
| 01120001      | Remediation                         | 12 |
| CMED9500      | Epidemiology                        | 15 |
| GE069210      | Computer Mapping and Data Display   | 12 |
| GEOG9230      | Population, Health and the          |    |
| 32003200      | Environment                         | 12 |
| CMED9519      | Demography in Community Medicine    | 10 |
| CMED9612      | Environmental Health                | 10 |
| ECON5116      | Environmental Economics             | 20 |
| FUEL5910      | Atmospheric Pollution and Control   |    |
|               | (Theory)                            | 12 |
| GEOG9130      | Soil Studies for Arid Lands         |    |
|               | Management                          | 12 |

| GEOG9150   | Remote Sensing Applications  | 12                                     |
|--|--|--|
| GE0G9160   | Directed Problems in Remote Sensing  | 12                                     |
| GE0G9240   | Principles of Geographical   |  |
| 02000240   | Information Systems  | 12                                     |
| 0500044  | Advensed Coographical Information  |  |
| GEOG9241   | Advanced Geographical Information  |  |
|  | Systems  | 12                                     |
| GEOG9280   | Application and Management of  |  |
|  | Geographical Information Systems   | 12                                     |
| GE0G9290   | Image Analysis in Remote Sensing   | 1                                      |
| GEOGO200   | Vogotation Management  | 12                                     |
| GEOG9300   | Diver Management   | 10                                     |
| GEOG9310   | River Management   | 12                                     |
| GEOG9320   | Soil Degradation and Conservation  | 12                                     |
| GEOL6231   | Coastal Environment Assessment   | 15                                     |
| GEOL9010   | Groundwater Environments   | 12                                     |
| GEOL9011   | Hydrogeology   | 12                                     |
| GEOI 9030  | Geological Engineering   | 12                                     |
| GEOL0033   | Terrain Evaluation   | 12                                     |
| GEOL0051   | Hydrogoochemistry  | 12                                     |
| GEOL9051   |  | 10                                     |
| GEOL9060   | Environmental Geology  | 76                                     |
| GMAT6532   | Spatial Information Systems 1  | 1.5                                    |
| GMAT7532   | Spatial Information Systems 2  | 5                                      |
| GMAT9211   | Introduction to Geodesy  | 12                                     |
| GMAT9212   | GPS Satellite Mapping  | 12                                     |
| GMAT0532   | Data Acquisitions and Terrain Modelling  | 12                                     |
| CMATOGOO   | Bringinles of Remote Sensing   | 12                                     |
| GMAT9600   | Findples of Renote Sensing   | 10                                     |
| GMA19604   | Land Information Systems   | 12                                     |
| GMAT9606   | Microwave Remote Sensing   | 12                                     |
| GSBE0503   | Postgraduate Design and Methodology  | 10                                     |
| HEAL9371   | Research and Evaluation Methods  | 15                                     |
| HEAL9421   | Public Health  | 15                                     |
| INDC4120   | Chemistry of the Industrial  |  |
| INDOTIE0   | Environment  | 75                                     |
|  | Environmental Chemistry of Industrial  | 1.0                                    |
| INDC4130   | Environmental Chemistry of Industrial  | F                                      |
|  | Processes  | 5                                      |
| KCME4301   | Environmental Management for the   |  |
|  | Mining Industry  | 12                                     |
| KCME4302   | Environmental Assessments in Mining  | 12                                     |
| LAND9010   | Environmental Heritage Studies   | 15                                     |
| LAND9111   | Landscape Planning   | 15                                     |
|  | Landscape Planning Methods   | 15                                     |
|  | Land Systems and Management  | 15                                     |
| LAND9213   | Land Systems and Management  | 15                                     |
| LAND9214   | Visual Landscape Assessment  | 15                                     |
| LAND9215   | GIS in Landscape Architecture  | 15                                     |
| LAWS3409   | Environmental Law and Policy   | 30                                     |
| LAWS3410   | Environmental Law  | 15                                     |
| MANE9410   | Total Quality Management   | 12                                     |
| MINE1524   | Mining Conservation  | 12                                     |
|  | Qualitative Research Methodology   | 15                                     |
|  |  | 10                                     |
| SAFE9211   | Introduction to Salety Engineering   | 12                                     |
| SAFE9232   | Introduction to OHS Law  | 12                                     |
| SAFE9242   | Effective Behaviour in Organisations   | 12                                     |
| SAFE9260   | Introduction to Occupational Health  | 12                                     |
| SAFE9261   | Occupational Hygiene   | 12                                     |
| SAFE9262   | Occupational Medicine  | 12                                     |
| SAEE0262   | Chemical Safety and Toxicology   | 12                                     |
| SAFE9203   | Diele Management   | 10                                     |
| SAFE9350   |  | 12                                     |
| SAFE9531   |  | - 12                                   |
| SAFE9543   | Industrial and Environmental Noise   | 4 -                                    |
| SAFE9544   | Management of Dangerous Materials  | 12                                     |
| SAFE9553   | Management of Dangerous Materials<br>Traffic Safety  | 12<br>12                               |
|  | Management of Dangerous Materials<br>Traffic Safety<br>Radiation Protection  | 12<br>12<br>12                         |
| SAFE9573   | Management of Dangerous Materials<br>Traffic Safety<br>Radiation Protection<br>Fire and Explosion  | 12<br>12<br>12<br>12                   |
| SAFE9573   | Management of Dangerous Materials<br>Traffic Safety<br>Radiation Protection<br>Fire and Explosion<br>Benot (Environmental Studies)   | 12<br>12<br>12<br>12                   |
| SAFE9573<br>SAFE9601                                     | Management of Dangerous Materials<br>Traffic Safety<br>Radiation Protection<br>Fire and Explosion<br>Report (Environmental Studies)<br>Penort (Environmental Studies)  | 12<br>12<br>12<br>12<br>4              |
| SAFE9573<br>SAFE9601<br>SAFE9602                         | Management of Dangerous Materials<br>Traffic Safety<br>Radiation Protection<br>Fire and Explosion<br>Report (Environmental Studies)<br>Report (Environmental Studies)  | 12<br>12<br>12<br>12<br>4<br>8         |
| SAFE9573<br>SAFE9601<br>SAFE9602<br>SAFE9603             | Management of Dangerous Materials<br>Traffic Safety<br>Radiation Protection<br>Fire and Explosion<br>Report (Environmental Studies)<br>Report (Environmental Studies)<br>Special Project (Environmental Studies)                                       | 12<br>12<br>12<br>12<br>4<br>8<br>) 12 |
| SAFE9573<br>SAFE9601<br>SAFE9602<br>SAFE9603<br>SCTS3106 | Management of Dangerous Materials<br>Traffic Safety<br>Radiation Protection<br>Fire and Explosion<br>Report (Environmental Studies)<br>Report (Environmental Studies)<br>Special Project (Environmental Studies<br>Technology, Sustainable Development | 12<br>12<br>12<br>12<br>4<br>8<br>) 12 |

CP

| SCTS3116             | The Political Economy of Energy and                               |    |
|----------------------|---|----|
|                      | Sustainable Development   | 15 |
| SCTS5303<br>SCTS5309 | Knowledge, Power and Public Policy<br>Analysing Environmental and | 15 |
|                      | Technological Controversies                                       | 15 |

Other subjects may be taken on the approval of the Course Coordinator:

All students must undertake an investigative project of 24 or 48 credit points. This project is expected to be complete within one University session (that is, six months). Students will require an academic supervisor for the duration of the project. Projects normally require the collection and analysis of data, leading to the preparation of a report of about 10,000 words (5,000-6,000 words in the case of a 24 credit point project). The project can be based on 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.

## 5488 Graduate Diploma in Environmental Studies

#### GradDip

The Graduate Diploma in Environmental Studies is similar to the Masters Program in Environmental Studies **8045**, in that it 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 Graduate Diploma in Environmental Studies course is to provide students and graduates with:

- A conceptual framework for the study of environmental issues and problems, including:
- · an understanding of natural systems and processes;
- an appreciation of how human activities impact on the environment;

- the ways in which these areas interact, including understanding of scientific, social, philosophical, economic, ethical, legislative and political concepts.
- knowledge and skills in a range of environmental subject areas, including environmental assessment, environmental planning, environmentally oriented decision-making and the ways in which various disciplines may be integrated together.

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.

One further 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.

#### **Entry qualifications**

A three year honours degree or equivalent, in a field relevant to environmental studies, or a four year degree in another field. Under exceptional circumstances, and at the discretion of the head of school, applicants with extensive experience in the environmental field, or with other professional or academic attainments, may also enrol in the Graduate Diploma program.

#### **Course Requirements**

Students enrolled on the Graduate Diploma in Environmental Studies are required to complete a course totalling 96 credit points made up of compulsory Core Subjects (24 credit points) and Elective Subjects (72 credit points). The structure of the course allows students to pursue specialised interests through the electives, or to develop new areas of expertise. Students may upgrade to the Masters in Environmental Studies upon completion of satisfactory progress. In such cases, students will be required to complete 144 credit points.

Core (minus the research project) and elective subjects are the same as those listed under the entry for the Master of Environmental Studies (8045).

## **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 person for the subject as listed. A guide to abbreviations and prefixes is included in the chapter 'Handbook Guide', appearing earlier in this book.

## SAFE9011

Physical Principles of Safety Staff Contact: Prof Jean Cross CP12

Solid mechanics: Force systems, friction equilibrium and stability, linear and rotational motion, energy, momentum, collisions, simple machines, stress strain relationships, bending stress, applications in safety and biomechanics. Fluid mechanics: properties of fluids, static and dynamic pressure in flowing systems, laminar and turbulent flow, friction losses. Forces on submerged objects, buoyancy, ship stability. Hydraulic and pneumatic systems. Applications in biomechanics, safety and ventilation.

#### **SAFE9012**

#### Statistics for Health and Safety Scientists Staff Contact: Ms Dianne Gardner CP12

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.

#### SAFE9210

#### **Research Methods (Project Students)**

Staff Contact: Ms Dianne Gardner CP12

This subject covers issues in research methodology including research problem formulation, null and alternative hypotheses, qualitative and quantitative research designs, statistical inference and the analysis of quantitative data. Students will be expected to be able to recognise and avoid common methodological problems in research. The subject will not provide a detailed coverage of statistical theory but a basic understanding of statistics is required.

#### SAFE9211

Introduction to Safety Engineering

Staff Contact: Dr Tony Green CP12

Assumed knowledge: SAFE9011 or PHYS1022

The engineering improvement of potentially hazardous workplace situations with reference to the following: safety management, safety audits, basic safety practice, management of dangerous materials; fire and explosion; ventilation; radiation protection; electrical safety; machine dangers and machine guarding; construction safety; transport safety; environmental safety; plant safety assessment; safety issues in different industries.

#### **SAFE9213**

#### Introduction to Safety Engineering M Staff Contact: Dr Tony Green

CP12

Assumed knowledge: SAFE9011 or PHYS1022 Note/s: This a modified version of SAFE9211 which is designed principally for engineers.

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: Mr Roger Hall CP12

Assumed knowledge: Basic statistics and mechanics

The subject will give an introduction to ergonomics, emphasizing the principles of designing user-centred, human-machine-environment systems. Topics include: definition of and justification for ergonomics, design and human error, human capabilities and limitations, controls and displays, design of human-machine- environment systems, job design and work organisation, introduction to anthropometry, design of workplaces, introduction to manual handling and the physical environment, and, introduction to product design and human-computer interaction.

#### SAFE9232

Introduction to Occupational Health and Safety Law Staff Contact: Head of School CP12

The concept of law: the creation and interpretation of statutes: the judicial and court systems: locus standi: common law and equity: basic principles of legal liability (civil and criminal): basic principles of administrative law and the liability of the Crown: the common law of employment: statutory regulation of employment: compulsory arbitration of industrial disputes. Outline of occupational health, safety and compensation legislation of the Australian States. Actions under the common law.

#### **SAFE9242**

#### **Effective Behaviour in Organisations**

Staff Contact: Ms Dianne Gardner

Human behaviour as a major system factor in occupational safety and health. Learning and safety programs. Attitudes and attitude change. Safety compliance individual and group factors affecting compliance. Work motivation and safety practice. Accident proneness and personnel selection. Individual differences in attitudes to work. Planning and implementing organisational change.

#### SAFE9260

#### Introduction to Occupational Health

Staff Contact: A/Prof Chris Winder CP12

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: A/Prof Chris Winder CP12

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: A/Prof Chris Winder CP12

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: A/Prof Chris Winder CP12

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 Kamal Kothiyal CP12 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: A/Prof Chris Winder CP12

Assumed knowledge: SAFE9262

A workplace assessment based subject, where students will be required to report on occupational health problems following visits to a number of diverse industrial sites.

#### **SAFE9267**

#### **Research Methods in Laboratory Science**

Staff Contact: Dr Boban Markovic

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.

#### SAFE9271

#### **Environmental Planning and Assessment**

Staff Contact: Dr Boban Markovic

This subject is a core element for the Graduate Diploma and Masters of Environmental Studies courses and provides the conceptual framework for understanding interactions between humans, nature, philosophy, law, politics, ethics and decision making and how this related to environmental planning and assessment. Also available as SAFE8271 (distance learning).

#### SAFE9272

Environment and Medicine Staff Contact: A/Prof Chris Winder

CP8

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: A/Prof Chris Winder CP8

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.

#### SAFE9274

#### Environmental Management Systems

Staff Contact: Dr Boban Markovic CP12

Assumed knowledge: SAFE9271

This subject is designed to define the central role of environment in management strategies. It describes the development of different approaches to fulfill the demands of the environment while considering not only the current legislative requirements but also customer requirements, competitive pressure and safety aspects of the firms respectively. Available as a short course.

#### SAFE9343

#### Innovation, Productivity and Safety

Staff Contact: Ms Dianne Gardner CP12

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.

#### SAFE9350 Risk Management

Staff Contact: Prof Jean Cross

CP12

This subject gives an overview of Risk Management following the format of the Draft Australian Standard in Risk Management. Tools and techniques applicable to each step of the risk management process are discussed using examples applicable to the class. The same risk management process is applied to manage a very wide range of business issues including health and safety, the environment, finance and project management. This subject is therefore relevant as part of a wide variety of postoraduate courses and students from any postgraduate course are accepted if numbers permit. The student selects examples for exercises to suit the industry and role in which they work ( or intend to work). At the end of the subject students should be able to use risk management tools applicable to their specific interest and have an awareness of tools used in other industries and applications.
## SAFE9354

Issues in Safety Management Staff Contact: Ms Dianne Gardner

CP12 This subject covers a range of issues in the management of risks in industry. It covers the planning, implementation

of risks in industry. It covers the planning, implementation and evaluation of risk management programs. Theoretical issues and practical applications in areas such as decision making, best practice, cost-benefit analysis, program implementation and program evaluation are covered and applied to health and safety, project management and other industrial risks. Case studies, discussion and other interactive approaches ensure active participation of class members. Students are expected to play an active role in class, to participate in discussions, to question and to share their own experiences and insights with others. From time to to time, guest lecturers will be invited to present subject material. Also available as SAFE8354 (distance learning)

## SAFE9424

Applied Ergonomics Staff Contact: Mr Roger Hall CP12 Prerequisite: SAFE9224 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.

## **SAFE9425**

Physical Ergonomics Staff Contact: Dr Kamal Kothiyal CP12

Assumed knowledge: SAFE9224 or equivalent

The focus of this subject is on the physical capabilities of humans at work and the effect of the physical environment on human performance. Measurement of relevant physical parameters and design and evaluation by computer. Topics include; applied anthropometry, workspace and workstation design, biomechanical models, emg measurement, manual materials handling, work physiology, fatigue, the visual, auditory and thermal environments, and the effect of vibration.

## **SAFE9426**

Ergonomics and New Technology

Staff Contact: Mr Roger Hall CP12

Assumed knowledge: SAFE9224 or equivalent

The focus of this subject is on ergonomic issues related to the design and implementation of new technology. Cognitive aspects of human-computer interaction, human error and software design, useability and its assessment, user interface design, evaluation techniques, guidelines and standards, and the introduction of new systems into organisations.

## **SAFE9523**

Plant and Construction Safety

Staff Contact: Dr Kamal Kothiyal

CP12

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, non-destructive testing.

## SAFE9531

## Industrial and Environmental Noise Staff Contact: Head of School

## CP12

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, annovance, phones dB(A) Leg Lbgt: Anatomy and function of the ear: Industrial deafness, Audiometry exercise in measuring hearing levels. Instrumentation, meters, filters, analysers and sound sources; Propagation in different environments, reverberent, 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.

## SAFE9543

#### Management of Dangerous Materials

Staff Contact: A/Prof Chris Winder CP12

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: Dr Andrew McIntosh CP12

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 CP12

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 CP12

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.

## SAFE9573

Fire and Explosion Staff Contact: Dr Tony Green CP12

This subject introduces students to the principles of combustion associated with fire and explosion hazards. The first section covers gas and liquid fires including the importance of the environment, control and regulation. The second section covers building fires and is mainly about solid combustibles, their control and regulation. The third section cover consequence analysis, risk analysis for major hazards and emergency and recover planning. All three workshops have case studies and group sessions on specific problems.

## SAFE9601

Report Staff Contact: Course Coordinator CP4

A four credit point report on a topic in safety science.

## **SAFE9602**

## Report

Staff Contact: Course Coordinator CP8

A eight credit point report on a topic in safety science.

## SAFE9603

Special Report Staff Contact: Course Coordinator CP12

Only for students enrolled in the Graduate Diploma courses.

## SAFE9606

Minor Report Staff Contact: Course Coordinator

CP24

## SAFE9609

Project Staff Contact: Dr Ronald Rosen CP36

#### **SAFE9612**

Project

Staff Contact: Professor Jean Cross (Safety Science) Staff Contact: A/Prof Chris Winder (Environmental Studies) Staff Contact: Mr Roger Hall (Ergonomics) CP48

## **SAFE9618**

Major Report Staff Contact: Professor Jean Cross CP72

## Centres in the Faculty of Applied Science

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 nine Centres either located within relevant Schools or in association with other Faculties.

Bioengineering Centre Centre for Applied Polymer Science Centre for Minerals Engineering Centre for Particle and Catalyst Technologies Centre for Remote Sensing and Geographic Information Systems Energy Research, Development and Information Centre (ERDIC) Key Centre for Mines UNESCO Centre for Membrane and Separation Technology 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.

In addition the Faculty of Applied Science is actively involved with eight Co-operative Research Centres (CRCs) established under the Commonwealth Government's program of CRCs announced in 1991. These are:

- Australian Maritime Engineering CRC
- Australian Petroleum CRC
- CRC for Aerospace Structures
- CRC for Biopharmaceutical Research
- CRC for Black Coal Utilisation
- CRC for Waste Management and Pollution Control
- CRC for Food Industry Innovation
- CRC for Premium Quality Wool

## **Bioengineering Centre**

## Director:

Professor P Gray

The Bioengineering Centre, within the Department of Biotechnology, aims to develop and coordinate research and continuing education activities in the multidisciplinary areas of bioengineering and recombinant-DNA technology.

Recent scientific advances and the ability to manipulate DNA in animal, plant and microbial cells are having far-reaching implications. The commercial applications of these scientific advances involve research and development work in a number of multidisciplinary fields. The Bioengineering Centre provides the mechanism to facilitate this multidisciplinary research.

The Centre assists in technology transfer to Australian industry and contributes to the education program of the University by providing short courses and symposia both in Australia and overseas.

Research programs range from microbial genetics to microbial mineral processing. Extensive facilities for animal and plant cell culture and for the production of recombinant-DNA derived products are utilised. Many of the Centre's research programs are collaborative, involving researchers from other areas of the University, industry and other organisations.

## **Centre for Applied Polymer Science**

## Director:

Associate Professor R Burford

The Centre for Applied Polymer Science has been established to encourage collaboration between groups which have significant activities in polymer science and engineering.

The multidisciplinary nature of Polymer Science is reflected by the fact that members of the Centre are drawn from ten Departments and Centres at UNSW with interests spanning biomaterials, textiles, packaging and industrial manufacture of resins. A priority in the establishment of this Centre therefore, is to bring together appropriate expertise to tackle multifaceted problems, rather than focus upon a single discipline.

The University is well equipped with major items of equipment for the study of polymer structures and morphology. High resolution surface analysers, electron microscopes, thermal analysers and other sophisticated facilities are able to be accessed by members of the Centre.

An example of interdisciplinary collaboration relates to recycling and waste minimisation. A program entailing aspects of design, polymer durability and selection is being mounted. New developments in polymeric packaging are also being investigated by the interaction of Food Technologists, Polymer Chemists and Engineers.

## **Centre for Minerals Engineering**

## **Co-Directors:**

Dr AC Partridge Dr T Tran

The Centre for Minerals Engineering (CME) coordinates and conducts teaching and research activities of relevance and concern to the minerals industry. The Centre is jointly run by the School of Chemical Engineering and Industrial Chemistry, the School of Mines and the School of Materials Science and Engineering.

Since the Centre started in 1991, it has established close links with industry and other research institutions. In 1992, the Centre commenced research in areas related to alumina and metallurgical waste processing.

Major research areas include processing of precious metals, treatment of mineral processing wastes, fundamental aspects of flotation, permeability, shear strength and particle segregation in stock-piles, coal preparation including effects of mining methods, numerical computational modelling of mineral slurry systems, distributors, and spiral concentrators.

Staff associated with the Centre participate in various training programs overseas and have organised workshops and short courses in collaboration with the Key Centre for Mines.

The Minerals Engineering elective is offered to students in Course 3040 who wish to obtain a basic training in preparation for a career in the mineral industry.

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 see the course outline for Course 3040 in the undergraduate section for the School of Chemical Engineering and Industrial Chemistry in this handbook.

# Centre for Particle and Catalyst Technologies

## Director:

Associate Professor J Raper

The Centre for Particle and Catalyst Technologies is located within the School of Chemical Engineering and Industrial Chemistry. It was established to encourage research in particulate systems and heterogenous catalysis undertaken within the University, and to promote unique University facilities as services available to industry and government bodies.

Special objectives of the Centre include promotion of testing facilities available within the University. Some 120 companies have sent samples for particle characterisation over the last two years. This has been achieved in conjunction with Unisearch (UNSW's corporate research arm), by the establishment of a centralised organisation for the allocation, review and management of short-term consultancy projects in particle and catalyst characterisation.

In addition to short-term projects, the Centre has been successful in attracting long-term industrial research contracts and research grants, resulting in improved transfer of technology to Australian industry in the areas of catalyst development, instrumental methods for particle and catalyst characterisation, and particulate systems.

The Centre also plays an important role in offering continuing education courses and conferences in areas relevant to industry.

The Centre houses much state-of-the-art equipment. These instruments allow staff and students to characterise particulate material in terms of size, surface area and other physical and chemical properties. The characteristics of particulate material influences its behaviour both as raw material and products in many industries.

Many of the measurement techniques have been developed within the Centre allowing the UNSW team to maintain its international reputation for expertise in particulate systems.

# Centre for Remote Sensing and Geographic Information Systems

## **Director:**

Professor BC Forster

The Centre is a joint multidisciplinary enterprise of the Faculty of Applied Science and the Faculty of Engineering aimed at facilitating research in the broad area of spatial information systems, which include remote sensing, geographical information systems and land information systems. It maintains a remotely sensed and geographical information system data repository.

Research interests include applications of artificial intelligence in remote sensing, neural networks in remote sensing, satellite mapping of bushfires, and vegetation mapping from remote sensing images. Other interests include monitoring urban areas using high resolution satellite remotely sensed data and spatial information systems for road based transport planning, evaluation and design. Applications using radar form a core interest of the Centre.

There are more than 30 academic staff associated with the Centre. Active links are maintained with researchers in Asia, North America, China and Europe.

The Centre offers undergraduate and postgraduate teaching and research in remote sensing and geographical information systems. The Centre also offers short courses on remote sensing and geographical information systems to the wider community.

## Graduate Programs in Geographic Information Systems

Master of Applied Science in Geographic Information Systems Course 8027.1000

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 Engineering Science Course **8652**. 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 8047.2000

Graduate Diploma in Remote Sensing Course 5047.2000

Detailed information on these courses is listed under the School of Geography and the School of Geology Sections in this handbook.

# Energy Research, Development and Information Centre (ERDIC)

## Director:

Associate Professor GD Sergeant

UNSW is a major centre for energy research and development in Australia across the full spectrum of energy technologies and issues. The University has internationally recognised expertise in fossil fuels technology, coal, oil, gas and biomass; solar energy, photovoltaic, thermal, passive, energy storage, vanadium batteries; energy efficiency in manufacturing, processing, buildings and transport, and economics and socio-economics.

ERDIC produces an annual report on all these activities; organises inter and multidisciplinary seminars and workshops on both current research and development, and future directions; publishes reports and newsletters; organises lectures; serves as a focal point for enquiries on energy research and development; and assists in bringing multidisciplinary teams together for consultation and research projects.

ERDIC has established itself as an internationally recognised Centre, providing a contact point for energy researchers in many disciplines within the University. It assists Federal and State Governments and industry to determine future policies and directions on energy research and development.

ERDIC disseminates information on energy issues via its seminars, workshops, meetings and newsletters. It is also a point of enquires in the wider community for information on energy technologies; particularly new and improved energy technology which are the key to safe, efficient and environmentally acceptable production and use of energy.

The Centre is also involved in the production of educational material. It has put together a twelve unit subject on energy management which is offered as a subject in the Master of Business and Technology Program at the University. The program is structured to enable it to be offered in packages of various units as shorter courses, both in Australia and overseas.

## **Key Centre for Mines**

## Director: Dr MB Kat

The Centre has the prime objective of providing appropriate postgraduate education and training for professionals within the mining industry who work in remote locations.

The Key Centre currently delivers a postgraduate program leading to either a Graduate Diploma or a Masters in Mining Management. The program is delivered by residential short courses and assignments and makes significant use of industry based presenters. The Key Centre also manages the presentation of a similar program in Geological Data Processing. In addition to the postgraduate programs, the Key Centre runs individual short courses on a commercial basis. It also offers customised short courses for companies and special purpose training programs, mostly for overseas professionals.

The Key Centre's main research role is to promote technology transfer through its short course program. To achieve this, it presents between 20 and 25 short courses each year and five special purpose seminars.

Information on the Centre's courses is detailed under the School of Mines section in this handbook.

## UNESCO Centre for Membrane Science and Technology

## **Directors:**

Professor HGL Coster (Biophysics Group) Professor AG Fane (Chemical Engineering Group)

The Centre for Membrane Science and Technology was formed in 1987 as a collaborative venture between the School of Chemical Engineering and Industrial Chemistry and the Department of Biophysics (in the Faculty of Science). In 1988 it was granted Commonwealth Special Research Centre status and funding, and in 1992 it became one of only four UNESCO Science Centres worldwide.

Research programs include fundamental research on both biomembranes, and membrane processes, as well as synthetic (industrial) membranes; membrane based manufacturing processes (chemical and biological reactor systems); product purification; purification of water; treatment and safe disposal of wastes, including sewage; biomedical applications; and membrane based biosensor technology. Other activities include the development of novel conducting membranes, membrane biophysics, membrane pervaporation and supported liquid membranes, and membrane-based systems using metal binding liquids to remove heavy metals.

The Membrane Centre maintains connections with membrane groups in China, Indonesia, Japan, Korea, Thailand, Indonesia, Malaysia and Singapore. It also has close links and collaborative projects operating with research institutes in Italy, France, Germany, Denmark, Finland, The Netherlands, the United Kingdom, the United States and Canada. The Centre organises postgraduate study programs, with up to half of its 25 students coming from countries other than Australia. It also offers shorter-term training programs for overseas trainees in aspects of membrane science and technology and runs specialist workshops on a diverse range of membrane related subjects.

## **UNSW Groundwater Centre**

Director: Dr JA Jankowski

The UNSW Groundwater Centre was created in 1987 and is a joint enterprise of the Faculties of Engineering and Applied Science. The Centre's facilities are based at the Water Research Laboratory in Manly Vale and in the Department of Applied Geology.

The Centre organises a Masters course in Groundwater Studies, as well as undergraduate and PhD training. The Masters course is completed full-time over a period of twelve months and offers specialisations in contaminant hydrogeology and groundwater resource development. Students from Iran, Canada, UK, Zambia, Malaysia, Thailand, Indonesia, and Botswana have studied at the Centre in recent years, as well as many Australian students.

The staff at the Centre work closely with the Cooperative Research Centre for Waste Management and Pollution Control to develop geophysical techniques for mapping dense non-aqueous phase liquid contamination of unconsolidated aquifer formations. This work has involved the development of new sample acquisition and recovery techniques and the development of integrated hydrogeochemical and geophysical laboratories at the Water Research Laboratory.

Major research interests include the development of hydrogeochemical and biogeochemical models for the occurrence of dry land salinity; the characterisation of flow in fractured aquifers using a combination of isotope techniques; and the assessment of airborne multispectral scanner and airborne radar for the mapping of aquifer recharge and discharge areas.

Several recent research projects have been targeted at understanding the movement of contaminants in the Botany Sands aquifer in Sydney. A number of deep multilevel piezometers have been installed in the Botany Basin in conjunction with a comprehensive test facility at East Lakes where 815 min-piezometers allow the accurate tracking of contaminant plumes.

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.

## The Australian Petroleum Cooperative Research Centre

## Director

## Professor WV Pinczewski

The Australian Petroleum Cooperative Research Centre (APCRC) was established in 1991 to bring together Australia's four main oil and gas research groups. These groups are the CSIRO Divisions of Exploration Geoscience and Geomechanics (now amalgamated into a new Division of Petroleum Resources), the Centre for Petroleum Engineering at UNSW, and the National Centre for Petroleum Geology and Geophysics at the University of Adelaide. Subsequently the Departments of Geophysics and Geochemistry at Curtin University have also joined. The Centre provides industry with a wide range of research, research and development, consulting and specialised laboratory services.

The focus of the APCRC's research and training scheme has been on upstream activities exploration and production to the well-head, with an emphasis on problems unique to the Australian environment. The Centre is currently running eight research programs. The Improved Oil and Gas Recovery Research Program aims to increase Australia's output of oil and gas by recovering oil from existing fields more efficiently, and by developing new technologies such as injecting carbon dioxide and methane into oil reservoirs which will no longer produce through more conventional methods. A more recent focus has been on the recovery of gas from low permeability reservoirs.

In addition the Centre for Petroleum Engineering provides major scientific input for the development of improved technology in the following programs:

For students, the APCRC offers the opportunity of entering the field with marketable skills. By working side-by-side with researchers from the CSIRO, UNSW, the Adelaide and Curtin University Centres and experts from the petroleum industry, students gain practical experience and expertise.

## **CRC for Biopharmaceuticals**

## University Contact:

Professor PP Gray

The Cooperative Research Centre for Biopharmaceutical Research was incorporated in 1992. The partners in the Centre include UNSW's Department of Biotechnology, School of Physiology and Pharmacology, and Biomedical Mass Spectrophotometry Unit; the Garvan Institute of Medical Research, St Vincent's Hospital, Sydney; the Biomolecular Research Institute, Peptide Technology Ltd; CSL Ltd; and Johnson and Johnson Research Pty Ltd.

The primary aim of the Biopharmaceutical Research CRC is to provide a coordinated research base to aid the development of the Australian biopharmaceutical industry. To achieve this goal, the Centre functions as a national centre for both the development of new internationally competitive biopharmaceutical products, and the education of research techniques and their integration with the industrial

goals necessary to develop products for the world market. The partners of the Cooperative Research Centre have all the necessary expertise for the discovery, design and development of novel biopharmaceutical products resulting from the recent rapid advances in the fields of genetic engineering and biotechnology.

The CRC provides a fertile environment for postgraduate study, as students can see the results of their research being developed into useful products.

## **CRC for Black Coal Utilisation**

## **University Contact**

Dr Veena Sahajwalla

The Centre was established in 1994. Research participants involved are the School of Materials Science and Engineering, CSIRO Division of Coal and Energy Technology, the University of Newcastle, the University of Queensland and the Australian Coal Industry Research Laboratories. Industry participants involved are ARCO Coal Australia, BHP Australia Coal, CRA Group, Oakbridge, Pacific Power Group and Peabody Resources.

The Centre's research objectives are to maximise the value and environmental performance of Australian coals –

- Generate new knowledge to improve the competitiveness of Australian coals; and
- Understand the performance of Australian coals in new technologies.

Research being undertaken at UNSW includes:

- Development of XRD technique to evaluate coal/gas reaction performance.
- Coal structure and its influence on coal/gas high temperature reactions.
- Slag surface tension determination and its modification to control slag/char interfacial phenomena.
- Fundamental investigation of slag/char/gas interactions and char reaction kinetics during pulverised coal injection in blast furnace..

## **CRC for Food Industry Innovation**

## Director:

#### Professor NW Dunn

The Centre was established in 1993 and involves the School of Applied Bioscience (Faculty of Applied Science), the Schools of Biochemistry and Molecular Genetics and Microbiology and Immunology (Faculty of Biological and Behavioural Sciences), CSIRO, and three industry partners to provide a coordinated research and educational base to generate development of improved and novel natural food ingredients, principally through the use of microorganisms.

The five partners in the CRC have the combined expertise in research and commercialisation to market the first ingredients within four years. The ingredients that the prepared for resource providers in accordance with the law and contractual arrangements; and accounting systems and reports designed for the decision makers within an organisation.

### ACCT5915 Individual Judgement and Choice Staff Contact: School Office S1 L3 CP20

This subject focuses on behavioural decision theory in the context of judgements made by users of accounting information, managers and auditors. Topics include: introduction to the fields of behavioural decision theory and decision analysis; limitations of human ability to process information; descriptive models of individual choice behaviour; other factors affecting judgement and choice; structuring of a problem; assessing consequences measurement and weighting of dimensions; assessing uncertainties probability assessment, confidence, group decision making; evaluation of alternatives choice of criterion; decision making; evaluation of alternatives choice of criterion; decision analysis involving multiple objectives and choice under uncertainty; ambiguity and choice; relationship between individual choice and organisational choice.

## ACCT5917

## Strategic Management: Systems and Processes Staff Contact: School Office

S1 L3 CP20

This subject explores the process and practice of strategic management - the constitution of an organisation's competitive positioning in its environment. Topics to be covered include: strategic thinking and analysis; the formulation and choice of strategic alternatives; managing extended strategic change; and the embedding of organisation al strategy in everyday activities. These topics are explored through a critical examination of relevant literatures, documented case studies and contemporary business practices.

## ACCT5931

## Strategic Management Accounting Staff Contact: School Office S1 L3 CP20

Prerequisite: ACCT5901 or ACCT5930 or equivalent.

This subject investigates various ways to allocate and manage organisational resources in a competitive environment. The focus is on value creation and cases are used to examine contemporary Australian and international best practice. Topics include value chain analysis; shareholder and customer value; strategic partnering and alliances; and selected topics from strategic management accounting such as benchmarking, the Du Pont methodology and product life cycle profitability.

## ACCT5932

## Public Sector Accounting and Financial Reporting Staff Contact: School Office S1 L3 CP20

Prerequisite: ACCT5901 or ACCT5930 or equivalent

A review of accounting methods applied by Commonwealth, State and Local Government entities. Fund accounting and cash-based reporting. Accrual-based reporting including a review of the issues associated with the measurement of assets and liabilities in the public sector. Infrastructure assets, heritage assets, and obligations arising from complex transactions. Departmental and whole of government reports. Issues arising from the 'commercialisation' of government units. Identification and costing of community service obligations. Performance indicators and the evaluation of financial performance and service quality.

## ACCT5949

Managerial Dynamics Staff Contact: School Office S2 L3 CP20

This subject examines the management of a technical specialty or specialist function (for example, the provision of accounting services) in an organisation. Topics include: service provision in 'intelligent enterprises'; technical specialists as managers; the nature of managerial work; managing patterns of interaction, discourse politics, commitment, ambiguity and change. Numerous case studies are used to examine issues.

## ACCT5956

Management Planning and Control Staff Contact: School Office S2 L3 CP20

Planning and control processes in organisations, and the involvement of management and management support personnel with them. Topics include: 'formal' and 'organisational' perspectives on management planning and control; planning and decision-making in organisations some alternative perspectives and descriptions; planning and budgeting - theoretical perspectives and organisational descriptions; organisation structures and structuration; control processes in organisations some alternative perspectives; participation as a mode of organisational control; accounting control systems some alternative perspectives; designing management accounting systems prescription or organisational choice; categorizing and evaluating the literatures on management planning and control.

## ACCT5996

## Management Accounting Control Systems Staff Contact: School Office

S2 L3 CP20 Proroquisito: ACCT

Prerequisite: ACCT5901 or ACCT5930 or equivalent

This subject examines the design and operation of management accounting systems in organisational settings. Topics include: the function of management accounting systems in organisations; design and organisational choice; design and operation of activity based costing systems; budgetary systems outcomes and processes; design and operation of accounting control systems responsibility accounting systems, standard costing and flexible budgets, relationships among accounting systems and administrative, social and personal control systems, divisional performance evaluation, transfer pricing.

## ACCT9002

Introduction to Accounting B Staff Contact: School Office S2 L1.5 CP7.5 Prerequisite: ACCT9001

This subject introduces non-commerce students to managerial accounting: long-range planning, budgeting and responsibility accounting; cost determination, cost control and relevant cost analyses.

## ANAT6151

Introductory Functional Anatomy Staff Contact: Dr E Tancred

An overview of basic human anatomy and physiology with an emphasis on structures and systems which are most vulnerable to chemical and physical trauma under industrial conditions, such as the eye, ear and skin. Other systems studied include the musculo-skeletal system, central and peripheral nervous systems, circulatory, respiratory, gastrointestinal, endocrine and urogenital systems.

## BIOC2101

Principles of Biochemistry Staff Contact: Dr K Moon, Dr G King CP15 S1 HPW6

Prerequisites: BIOS1101 and BIOS1201, CHEM1101 and CHEM1201 or CHEM1002

**Note/s:** Excluded BIOC1319, BIOC2312, BIOC2372, CHEM2929. Enrolment in this subject may be subject to quota restrictions. Such restrictions will only apply to students taking this subject as an elective part of their program.

An introduction to modern biochemistry covering fundamental aspects of the structure-function relationships of proteins and an overall coverage of intermediary metabolism. Major topics to be covered will include: the nature and function of enzymes; the metabolic working of cells, tissues and organs; the interrelationships between the pathways of carbohydrate, lipid and amino acid metabolism; the vital role of enzymes and hormones in catalysis and metabolic regulation; the energy-trapping mechanisms of animals and plants; interesting variations on the central metabolic pathways in various life forms. Practical work to complement the lectures and to introduce the principles of biochemical analysis.

## BIOC2201

Principles of Molecular Biology Staff contact: Dr T Stewart, Mr H Shoory CP15 S2 HPW6 Prerequisite: BIOC2101 Note/s: Excluded BIOC2312, BIOC2372.

Enrolment in this subject may be subject to quota restrictions. Such restrictions will only apply to students taking this subject as an elective part of their program.

This subject provides an introduction to modern molecular biology and covers the molecular mechanisms of gene expression and the fundamental aspects of recombinant DNA technology. The major topics to be covered include: The structure and function of DNA and RNA. The replication and transcription of DNA. Translation of the genetic code into an amino acid sequence during protein synthesis. Regulation of gene expression. Manipulation of DNA including fragmentation by restriction enzymes, cloning of DNA fragments into vectors, hybridization analysis and principles of DNA sequencing. Protein structure and function, protein engineering and site-directed mutagenesis. Amplification of DNA by the polymerase chain reaction (PCR). Practical work to complement the lectures.

## BIOC2291

An Introduction to Molecular Biology Staff Contact: School Office CP15 S2 HPW6 Prerequisites: BIOS1101 and BIOS1201, CHEM1101 and CHEM1201 or CHEM1002 Note/s: Excluded BIOC1319, BIOC2201, BIOC2312, BIOC2372, CHEM2929.

This subject provides a comprehensive introduction to Molecular Biology as an alternative to BIOC2201 for students who do not intend to proceed to level III Biochemistry. It does not fulfill the prerequisite requirements for level III Biochemistry but the Head of School may give approval for students with a grade of credit to enrol in level III subjects.

This subject provides an introduction to modern molecular biology and covers the molecular mechanisms of gene expression and the fundamental aspects of recombinant DNA technology. The major topics to be covered include: the structure and function of DNA and RNA; the replication and transcription of DNA; translation of genetic code into an amino acid sequence during protein synthesis; regulation of gene expression. Manipulation of DNA including: fragmentation by restriction enzymes; cloning of DNA fragments into vectors; hybridazation analysis and principles of DNA sequencing. Protein structure and function. Amplification of DNA by the polymerase chain reaction (PCR). Practical work to complement the lectures.

This subject covers the same material as in BIOC2201 Principles of Molecular Biology, but in less detail <N>and with more emphesis on the general applications and less emphesis on some of the underlying mechanisms.

## BIOC3111

Molecular Biology of Proteins

Staff Contact: Dr G King CP15 S1 HPW6 Prerequisites: BIOC2312 or BIOC2372 or BIOC2101 and BIOC2201, CHEM2021 or CHEM2041 Note/s: Excluded 41.102, 41.102A.

Modern aspects of the structure function 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 protein 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.

## BIOC3121

## Molecular Biology of Nucleic Acids

Staff Contact: School Office CP15 S1 HPW6 Prerequisites: BIOC2312 or BIOC2372 or BIOC2101 and BIOC2201, 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, DNA-DNA and DNA-RNA 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: School Office CP15 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 eukarvotic genomes in terms of the organisation of single copy and repeated sequences and of coding and non-coding 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 nuclease-free conditions, using basic techniques such as hybridisation and DNA sequencing.

## BIOC3291

Genes, Genomes, and Evolution Staff contact: Dr A Wilton CP15 S2 HPW6 Prerequisite: BIOS2021

Current concepts and theories in genetics concentrating on Eucaryotes including humans. The generation of variation examined at the molecular level for fundamental genetic process of mutation, recombination and repair. The evolution of the genome, maintenance of variation, the effects of mutations and their relevance to disease. Ecological genetics and molecular evolution, genetics of cellular division process and developmental genetics. Practical uses of genetics including the use of transposable elements to manipulate genetic stock, transgenesis, genetics of cancer, pedigree analysis, disease gene mapping, gene therapy, cytogenetics. Unusual genetic mechanisms.

## BIOM9027

Medical Imaging Staff Contact: A/Prof CD Bertram

CP16 S2 L2 T2 *Prerequisites:* Assumed knowledge/prerequisites BIOM9028, BIOM9010

Fundamentals of producing a medical image, image collection techniques, image reconstruction algorithms. Detailed examination of four main areas of medical imaging: Nuclear Medicine and Positron Emission Tomography, Ultrasound, Diagnostic Radiology, Magnetic Resonance. Clinical application of each area.

## BIOM9028

## Radiation Physics Staff Contact: A/Prof BK Milthorpe CP12 S1 L2 T1

Basic physics of interaction of photons and particles with matter. Nuclear/atomic structure, nuclear reactions, radioactivity counting statistics, dosimetry, detectors. Radiation biology, interaction of ionising radiation with water and tissues. Radiotherapy. Medical uses of non-ionising electro-magnetic radiation.

## BIOM9060

## Biomedical Systems Analysis Staff Contact: Dr R Odell CP12 S1 L2 T1 Corequisite: BIOM9101 or equivalent Note/s: Mathematics background required.

Analysis of compartmental systems in biology and medicine. Applications include pharmacology, physiology and nuclear medicine. Topics include the mathematics of linear compartmental systems, non-linear systems, tracer methods, parameter estimation by fitting models to date, the optimum design of experiments, and methods of control.

## BIOM9321

Physiological Fluid Mechanics Staff Contact: A/Prof CD Bertram CP16 S2 L2 T2

Fluid mechanics of unsteady flow. Fundamentals of biological fluid flow by way of the governing equations. Kinematics and dynamics, viscous and inertial flow, boundary layers, separation, physiological flows (cardiac, vascular, pulmonary, urinary, etc.) and flow in artificial organs. Emphasis on physical rather than mathematical understanding of the relevant phenomena, to allow realistic appraisal of the nature of flow in a given organ.

## BIOM9332

## **Biocompatibility**

Staff Contact: Dr L Poole-Warren CP12 S2 L2 T1

Interaction of biological fluids and cells with foreign surfaces, in vitro tests to assess biocompatibility and thrombogenicity, current status of biocompatible materials as applied to extracorporeal systems, surgical implants and prosthetic devices.

## **BIOM9410**

Regulatory Requirements of Biomedical Technology. Staff Contact: Dr L Poole-Warren CP12 S2 L2 T1

The regulatory requirements of medical devices in Australia, Japan, North America and Europe will be reviewed. Data collation and documentation methods are examined, case studies of medical device registration will be presented.

## BIOM9430

## **Electromedical Standards**

Staff Contact: Dr AP Avolio CP12 S2 L2 T1

Basic effects of electricity on the human body, threshold of ventricular fibrillation, termination of leakage currents, statistical basis of experimental data used to define limits of leakage currents. Formation of safety standards for electromedical equipment. Mechanisms of approval of electromedical equipment. Acceptance testing procedures. Certification schemes for electromedical equipment. National and international legal requirements.

## BIOM9510

Introductory Biomechanics Staff Contact: Prof K Schindhelm CP12 S1 L2 T1

The principles of the mechanics of solid bodies, force systems, kinematics and kinetics of rigid bodies, stress-strain relationships, stress analysis of simple elements application to musculoskeletal system.

## BIOM9541

Mechanics of the Human Body Staff Contact: School Office CP12 SS L2 T1 Prerequisites: BIOM9510 and ANAT2111

Statics and dynamics of the musculoskeletal system: mathematical modelling and computer simulation, analysis of pathological situations.

## BIOM9621

**Biological Signal Analysis** 

Staff Contact: A/Prof CD Bertram

CP12 S1 L1 T2

**Note/s:** Basic electronics and mathematics background required.

Use of digital computers to extract information from biological signals. Signal processing using filtering, averaging, curve-fitting and related techniques, and analysis using model simulations, correlation, spectral analysis etc.

## BIOM9701

## **Dynamics of the Cardiovascular System**

Staff Contact: A/Prof CD Bertram CP12 S1 L2 T1

Note/s: Some mathematics background desirable.

Structure of the heart; organisation of the mammalian vasculature; mechanical, electrical and metabolic aspects of cardiac pumping; the solid and fluid mechanics of blood vessels; rheology of blood.

## BIOS1011, 1021, 2011, 2021, 2031, 2051, 2061, 3014, 3061, 3071

Registration for these subjects will be held at the Biological Registration Centre in Biology Lab A (room G20, Biological Science building) as follows: 17-21 Feb 10.00-17.00

| 17-61 | 1.60 | 10.00 17.00 |
|-------|------|-------------|
| 24-28 | Feb  | 10.00-17.00 |

Students must obtain practical slots at that time for:BIOS2011Evolutionary and Physiological EcologyBIOS2021Introductory GeneticsBIOS2051Flowering PlantsBIOS2061Vertebrate ZoologyBIOS3071Conservation Biology and Biodiversity

Pre-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, Room G27 or from the notice boards on the fifth floor of the Biological Sciences Building

**Note:** Some subjects that appear in this section may be restricted to students for whom the subject comprises a compulsory part of their program.

## BIOS1101

Evolutionary and Functional Biology Staff Contact: Dr ML Augee CP15 S2 HPW6 Note/s: Excluded: BIOS1301 and BIOS1021.

The subject examines the evolutionary history of life on earth and the relationship between environment, adaptation and function. <N>Animal and plant physiology are covered with an emphasis on adaptation to Australian environmental conditions.

Practical and tutorial seat assignments must be obtained at the Biology Enrolment Centre on the day of enrolment. 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 if for details of the course and assessments.

## **BIOS1201**

## Molecules, Cells and Genes

Staff Contact: Dr ML Augee

CP15 S1 HPW6

*Prerequisites:* HSC Exam Score Required: 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 3 unit Science 90-150, or 4 unit Science 1-50. Excluded: BIOS1011 and BIOS1301.

Note/s: Prerequisites for BIOS1201 are minimal (and may be waived on application to the Director) Practical and tutorial seat assignments must be obtained at the Biology Enrolment Centre on the day of enrolment. 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 if for details of the course and assessments

The subject is concerned with the basic characteristics of life. The chemistry of life is covered with emphasis on the way in which living things construct and break down macromolecules. The way in which the genetic code controls these processes depends to a great extent on the structure and function of cell components, and cell biology is a major component of the subject. The final topic is genetics the way in which the genetic code is inherited and the ways in which it can be modified.

## **BIOS2011**

#### Evolutionary and Physiological Ecology Staff Contact: Dr P Steinberg

CP15 S1 HPW6

Prerequisites: BIOS1011 and BIOS1021 or BIOS1101 and BIOS1201

Note/s: Students must enrol at the Biological Science Registration Centre, Room G20, Biological Sciences Building, For further details, see Faculty timetable.

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 CP15 S2 HPW6 Prerequisites: BIOS1011 and BIOS1021 or BIOS1101 and BIOS1201, CHEM110 Coreauisite: CHEM1201

Note/s: Enrolment in this subject may be subject to quota restrictions. Such restrictions will only apply to students taking this subject as an elective part of their program. Students must enrol at the Biological Science Registration Centre, Room G27, Biological Sciences Building. For further details, see Faculty timetable.

Genome structure and life cycles in prokarvotes and Eukaryotes: DNA, gene mapping, cytogenics, Genetic transmission, mutation, recombination, Gene regulation, interaction and development. Genetic variation and evolution of molecules, populations and species; Mating, selection, migration, population size, mutation, environment. Applications, including humans and genetic engineering.

## **BIOS2051**

## **Flowering Plants**

Staff Contact: Prof A Ashford

**CP15 S2 HPW6** 

Prerequisites: BIOS1011 and BIOS1021 or BIOS1101 and **BIOS1201** 

Note/s: Enrolment in this subject may be subject to guota restrictions. Such restrictions will only apply to students taking this subject as an elective part of their program. Students must enrol at the Biology enrolment Centre, Room G27, Biological Sciences Building, For further details, see Faculty timetable.

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, micro-organisms 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

## **BIOS3014**

**Ecological Studies in Arid Lands Management** Staff Contact: Dr D Croft CP15 S212 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.

## BIOS3051

## Insect Diversity and Management

Staff Contact: Dr C Orton **CP15 S1 HPW6** Prerequisite: BIOS2031 Note/s: Not offered in 1997.

Insect diversity, classification and identification, internal and external anatomy. Insect ecology, physiology and behaviour, including pheromones. Management of urban and agricultural insect pests, insecticides and their action, resistance, advantages and disadvantages of pest control methods. Practical classes to illustrate lectures. Students must present insect collection for assessment.

## **BIOS3061**

## Plant Ecosystem Processes Staff Contact: A/Prof R McMurtrie CP15 S1 HPW6

Prerequisite: Any 2 Level II Science subjects

Interactions of plants with their soli and atmospheric environments. Plant growth and decomposition processes. Cycling of carbon, water and nutrients in plant ecosystems. Role of fungi in ecosystems. Mineral nutrition and water uptake in plants. Root systems. Plant strategies for improving mineral nutrition. The role of symbiosis in mineral nutrition. Impacts of global change on vegetation. Role of terrestrial ecosystems in the global carbon budget. Relating vegetation to climate.

## BIOS3071

**Conservation Biology and Biodiversity** Staff Contact: Dr W Sherwin

CP15 S1 HPW6

Prerequisites: BIOS1011 and BIOS1021 or BIOS1101 and BIOS1201, plus any 2 Level II Biological Science subjects (the latter may be waived upon application to the subject coordinator)

Note/s: Students must enrol at the Biology Enrolment Centre, Room G27, Biological Sciences Building, For further details, see Faculty timetable.

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.

## BIOS3111

Population and Community Ecology Staff Contact: A/Prof B Fox CP15 S2 HPW6 Prerequisites: BIOS1021 and MATH1032 or MATH1231 or MATH1042 or MATH1241 or MATH1021

Factors regulating dynamics of interacting populations, renewable resource management, ecosystem stability, cycles and chaos, simulation modelling in ecology, niche theory, competition, habitat selection, community structure, species diversity, island biogeography, ecological gradients. Succession following disturbance (fire, mining, or logging). Participation in fieldwork is essential.

#### CHEM1101 Chemistry 1A

Staff Contact: Dr P Chia CP15 S1 or S2 HPW6

*Prerequisites:* HSC Mark Range Required: 2 unit Mathematics 60-100, or 3 unit Mathematics 1-50, or 4 unit Mathematics 1-100 and 2 unit Chemistry 65-100, or 3 unit Science 90-150, or 4 unit Science 1-200, or 2 unit Physics 75-100, CHEM1401 60 or higher.

Stoichiometry and solution stoichiometry. Atomic and molecular structure. Changes of state, phase diagrams, gases, liquids, solids, solutions. Thermodynamics. Equilibrium constants, acid-base and solubility. Oxidation and reduction. Kinetics.

## CHEM1201

Chemistry 1B Staff Contact: Dr P Chia CP15 S2 or Summer Session HPW6 Prerequisite: CHEM1101

Note/s: Students who require CHEM1101 and CHEM1201 but have not undertaken chemistry at HSC Level should take CHEM1401 before proceeding to CHEM1101. However, no more than 30 Credit Points of Chemistry at Level I may be counted towards a Science degree.

Molecular Geometry, hybridization of Orbitals. Periodicity of Physical and Chemical Properties of Chemical compounds.

Organic Chemistry including Stereoisomerism.

## CHEM1401

Introductory Chemistry A Staff Contact: Dr P Chia

## CP15 S1 HPW6

Prerequisites: HSC Mark Range Required: 2 unit Mathematics 60-100, or 3 unit Mathematics 1-50, or 4 unit Mathematics 1-100.<R>Note/s: This subject is only for students who do not have the prerequisite for CHEM1101. Students proceeding to CHEM1101 must attain a mark of 60 or higher.

Stoichiometry and solution stoichiometry. States of matter, changes of state, phase diagrams, gases, liquids, solids, solutions. Equilibrium, introduction to organic chemistry.

## CHEM1807

Chemistry 1ME Staff Contact: Dr P Chia CP15 S1 HPW6 Note/s: excluded CHEM1101, CHEM1201, CHEM1002 Restricted to Course 3681

Stoichiometry. Atomic and molecular structure. Chemistry of materials. Thermochemistry. Kinetics. Equilibrium. Oxidation and reduction, electro-chemistry and corrosion of metals. Introduction to organic chemistry, structure and properties of polymers, fuels and lubricants. Surface chemistry.

## CHEM2021

Organic Chemistry Staff Contact: Dr R Read CP15 F or S2 HPW6 Prerequisites: CHEM1101, CHEM1201

Discussion of the major types of organic reaction mechanisms, eg 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 Duffy CP15 S1 or S2 HPW6 Prerequisites: CHEM1101, CHEM1201

Experimental basis for theories of electronic structure of atoms and molecules. Concepts and consequences of quantum theory. Structure, energetics and bonding in the solid state. Principles of co-ordination chemistry. Occurrence, preparation, properties and reactions of selected compounds of transition and main group elements.

## CHEM2041

Chemical and Spectroscopic Analysis Staff Contact: Dr M Mulholland CP15 S1 or S2 HPW6 Prerequisites: CHEM1101, CHEM1201, MATH1032 or

Prerequisites: CHEM1101, CHEM1201, MATH1032 or MATH1231 or MATH1042 or MATH1241 or MATH1021

General procedures in analytical science, accuracy, propagation of errors, precision. Analytical equilibrium chemistry, titrimetric and gravimetric analysis. Solvent extraction. Electroanalytical methods. Chromatography. Optical spectroscopy, instrumental aspects of all major spectroscopic methods.

## CHEM2818

## Physical Chemistry for Materials Science and Engineering

Staff Contact: Prof RF Howe

S1 or S2 HPW5

Prerequisites: CHEM1002 or CHEM1101 and CHEM1201 and MATH1042 or MATH1241 or MATH1032 or MATH1231 or MATH1021 Note/s: Excluded 02.022A.

First, second and third laws of thermodynamics. Applications of thermodynamics. Chemical and phase equilibria. Solutions of electrolytes and non-electrolytes. Principles and applications of electrochemistry. Reaction kinetics order and molecularity; effect of temperature on reaction rate.

## CHEM2819

## Physical Chemistry for Food and Fibre Science and Technology

Staff Contact: Prof RF Rowe S1 or S2 HPW6 Prerequisites: CHEM1002 or CHEM1101 and CHEM1201 and MATH1042 or MATH1241 or MATH1032 or MATH1231 or MATH1021 Note/s: Excluded 02.002A.

First, second and third laws of thermodynamics. Applications of thermodynamics. Chemical and phase equilibria. Solutions of electrolytes and non-electrolytes. Principles and applications of electrochemistry. Reaction kinetics order and molecularity; effect of temperature on reaction rate. Colloid and surface chemistry; liquid surfaces, surface tension, adsorption, surfactants and detergency, colloidal dispersions and micelles, solid surfaces and adsorption on solids.

## CHEM2828

## Organic and Inorganic Chemistry for Chemical Engineers

Staff Contact: Dr D Phillips

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 Southwell-Keelv

Aspects of the chemical and physical properties of materials important in biological systems. Amino acids, peptides and introduction to protein structure. Chemistry of monosaccharides, disaccharides and polysaccharides. Fats. Trace elements. Common heterocyclic systems of biological importance. Insecticides. Colour. Chromatography.

## CHEM3021

Organic Chemistry Staff Contact: A/Prof R Bishop CP15 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, eg nuclear magnetic resonance, mass spectrometry, to determination of organic structures.

## CHEM3121

Synthetic Organic Chemistry Staff Contact: Prof M Paddon-Row CP15 S2 HPW6 Prerequisite: CHEM3021

Modern functional group transformations with particular reference to positional and stereochemical control. Pericyclic reactions and photochemistry; Woodward-Hoffman rules. Principles of planning organic synthesis; disconnection approach.

## CHEM3321

Applied Organic Chemistry Staff Contact: A/Prof N Cheetham CP15 S1 HPW6 Coreouisite: 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

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 N Cheetham

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 F L1 T3

Student enquiries should initially be directed to the Course Coordinator A/Prof P Southwell-Keely.

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.

## CIVL0616

#### Structures

Staff Contact: A/Prof VA Pulmano

CP7.5 S1 L1 T2

**Note/s:** This is a servicing subject for courses offered by other schools and faculties. This subject is not offered every year.

Theory of structures: Moduli of elasticity, simple stress and strain. Compound bars, temperature stresses. Thin shells. Stress at a point. Strain at a point. Principal stresses and strains. Relationship between load, shear force and bending moment. Moments of inertia, principal moments of inertia. Stresses due to axial force, bending moment, shear force, and torsion. Differential equations of simple beam theory. Deflection of beams. Statically indeterminate beams. Strain energy. Deflections at a single load. Shock loads. Theory of centrally loaded column and eccentrically loaded columns.

## CIVL4306

Engineering and the Environment Staff Contact: Mr GR Mostyn CP10 S1 L2 T2 Prerequisite: CIVL3601

Engineering impact on the environment, the conservation movement and the response of engineers. Principles of ecological systems and the environment: short-term and long-term impact of engineering on land, water, air and noise. The Australian national conservation strategy. Public attitudes: community involvement as an integral part of the planning process, risk perceptions. Environmental methodologies: environmental and social impact statements, methods for measuring and predicting impact. Assessment of engineering on the biophysical and social environment. Impact of current engineering activity on the future distribution of resources. Decision making methodologies for engineering and non-engineering groups. Planning for non-optimal engineering solutions. Professional ethics.

#### CIVL8701

Financial Management Staff Contact: Dr RR Wakefield CP12 S1

Project initiation and development, feasibility studies, planning; economics, review of practical decision-making problems and relevant techniques, benefit/cost analysis, methods of economic appraisal; consideration of inflation and taxation in investment decisions; depreciation; management decision processes, decision theory, utility; life-cycle costing, value management; models and techniques to assist the manager, forecasting; optimization; applications; multiple objective planning; project delivery systems; financial planning, accounting.

## CIVL8702

Project Time Management Staff Contact: Dr RR Wakefield CP12 S2

The planning process; time estimating; the link between planning and control; control systems; the critical path method, networks, resource levelling, resource constrained scheduling, network compression, overlapping relationships, applied cpm, cost influences, project control, legal considerations, simulation in networks, stochastic networks, project management, applications.

## CIVL8703 Quality and Quality Systems Staff Contact: Dr PR Gibson CP12 S2

Quality management principles, practice and responsibilities; applications; quality systems documentation, manuals, implementation and procedures; quality assurance; quality control; relevant codes on quality; total quality management, quality circles and related approaches; quality requirements in contracts; continuous improvement.

## CIVL8706

## Human Resources Management

Staff Contact: Mr JB O'Brien CP12 S2

The development of skills for the management of people and their workplaces; industrial relations, health and safety issues, the recognition of people as the basic unit of engineering productivity and engineering organisations; negotiating theory and practices; the structure and function of organisations, management of group action; work delegation across organisational boundaries; interpersonal skills, conflict management; learning curves; motivation.

## CIVL8707

#### Contracts Management Staff Contact: Prof DG Carmichael CP12 S1

Elements of contract law and a contract; contracts; contract documents including specifications; procurement methods (contract or project delivery strategies); tendering; time in contracts; variations; payments; rights and obligations; planning and programming; risk management and insurance; dispute resolution and dispute avoidance; claims.

## CIVL8710

#### Management of Risk Staff Contact: Mr G Nawar CP12 S2

Introduction to the concept of risk and decision making under conditions of uncertainty; project objectives and planning, risk/factors affecting project performance; risk identification in engineering processes; human error, natural hazards and unforeseen risks; risk evaluation and quantification methods; relevant statistical techniques; risk avoidance and minimisation; financial risk, portfolio theory, risk sharing and financing; ambient and acceptable risk levels; insurances.

## **CIVL8726**

## Legal Studies and Professional Practice Staff Contact: Prof DG Carmichael CP12 SS

Note/s: This subject is not offered every year.

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.

## CIVL8731

## Project Management Framework Staff Contact: Mr JB O'Brien CP12 S1

An overview of project management; the nature of technical and non-technical projects; the project life cycle; the project team, organisational and behavioural aspects; the project manager; the organisation and management of project resources; project success evaluation techniques; project delivery; management information and decision support systems; case studies in project management; management theory and processes; relationship to general management; functions of project management.

## **CIVL8872**

Solid Waste Management Staff Contact: Mr SJ Moore **CP12 SS** 

Note/s: This subject is not offered every year.

Characterisation of municipal solid waste; collection; transfer stations; waste minimization and recycling; waste treatment, including size reduction, composting, incineration, emerging technologies; landfill disposal, including preparation of landfill management plans and operational aspects; introduction to planning of waste management systems.

## CIVL8881

Hazardous Waste Management Staff Contact: Mr SJ Moore CP12 SS Note/s: This subject is not offered every year.

Waste audits and characterisation of hazardous wastes in regions and industries; control of generation and transport of hazardous waste, manifest systems; waste minimisation; on-site treatment methods; integrated off-site treatment facilities; management of residues from treatment facilities; introduction to planning of regional hazardous waste management systems. Characteristics of individual waste types (dioxins, PCBs, pesticides, heavy metal, etc.) and waste management in individual industries (steel, pulp and paper, petro-chemical, food processing, etc.).

## **CIVL9402**

## Transport, Environment, Community

Staff Contact: Dr SE. Samuels CP24 F

Note/s: This subject is not offered every year.

Effect of transport on public health, environment and communities. Analysis of unwanted effects of transport activity: accidents, noise, pollution, intrusion; causation. measurement, preventative and remedial action. Community reaction to transport activity; government, bureaucracy and public involvement in transport policy and environment impact statements.

## CIVL9403

#### Theory of Land Use Transport Interaction Staff Contact: Dr SE Samuels CP12 SS

Note/s: This subject is not offered every year.

Theoretical aspects of land use transport planning. Basic concepts, data collection methods, systems models and equation of state function (behavioural, optimizing). Introduction to land use-transport modelling (land use, generation, distribution, modal assignment, network assignment, evaluation). Planning methodologies (short-, medium-, long-term; action planning, strategic planning; local, urban, regional, national).

## **CIVL9405**

## **Urban Transport Planning Practice**

Staff Contact: Dr SE Samuels CP12 SS

Note/s: This subject is not offered every year.

Analytical techniques for urban land use/transport planning practice. Planning methodology: traffic generation, trip distribution, modal-choice, traffic assignment, evaluation. Land use forecasting: calibration and verification of behavioural models, application of mathematical

programming models, case studies, public transport problems.

## CIVL9408

Transport Systems Design (Urban) Staff Contact: Dr SE Samuels CP12 SS

Note/s: This subject is not offered every year.

Types of urban transport facilities. Distributors, streets, bicycle routes, walk-oriented areas, bus lanes and rapid transit lanes, stops and change terminals, noise control. Minimum geometric form; speed range controls, provision for surface water on urban roads, landscape. Design of intersection and parking areas.

## CIVL9726

## Legal Studies and Professional Practice

Staff Contact: Prof DG Carmichael CP12 SS

Note/s: This subject is not offered every year.

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 CP12 SS

Note/s: This subject is not offered every year.

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 CP12 S2

Note/s: Short course format in 1997.

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: Dr GE Swarbrick

**CP12 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.

## CIVL9851

## Unit Operations in Public Health Engineering Staff Contact: Mr PJ Bliss CP12 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.

## CIVL9855

## Water and Wastewater Analysis and Quality Requirements

Staff Contact: Ms PA FitzGerald CP12 S1

The effects of impurities in water and wastewater on its suitability for various beneficial uses, and methods used for detecting impurities. Analytical methods used in water and wastewater treatment for monitoring and process control.

## CIVL9856

Water Treatment Staff Contact: Ms PA FitzGerald

CP12 S2

Application of processes and process variations used to upgrade the quality of water for specified uses, with particular reference to the treatment of water for municipal use.

## CIVL9857

Wastewater Treatment and Disposal Staff Contact: Mr PJ Bliss CP12 S2

Application of processes and process variations used to improve the quality of wastewaters and of sewage effluent, and the disposal of the effluent. Re-use of effluents where applicable. Sludge treatment and disposal.

## CIVL9858

Water Quality Management Staff Contact: Prof TD Waite CP12 S2

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 and regulatory criteria relating to water use and re-use systems.

## CIVL9860

## Investigation of Groundwater Resources

Staff Contact: Dr RI Acworth CP12 S1

Physical properties of groundwater. Darcy flow; porosity, hydraulic conductivity and intrinsic permeability field and laboratory tests. Principles of groundwater flow. Storage and transmissivity. Groundwater in the hydrological cycle; flow nets; local and regional flow systems; springs; interactions with surface water. Drilling methods; well design and completion. Borehole geophysical methods. Solutions to the radial flow equation; pumping test interpretation. Groundwater modelling; finite difference methods. Program of field work and data analysis.

## CIVL9861

## Remote Sensing in Contaminated Site Assessment Staff Contact: Dr RI Acworth

CP12 SS Prerequisite: CIVL9860

Note/s: This subject is not offered every year.

Electrical properties of water, soil, rock and contaminants. The frequency dependence of electrical conductivity/relative permittivity. Relationships between porosity, clay content, fluid conductivity and bulk electrical conductivity.Electrical conductivity sounding and profiling using galvanic and induction methods. Electrical conductivity imaging. Forward and inverse modelling of conductivity images. Electrical tomography. Time domain electromagnetic methods. Ground probing radar. Time domain reflectrometry measurements. Gamma, neutron and FM borehole measurements. New technologies. Case studies related to contaminated site assessment.

## CIVL9862 Fluvial Hydraulics

Staff Contact: A/Prof RJ Cox CP12 S2

Unsteady and varied flow in non-uniform channels, secondary currents, sediment transport, channel morphology, scour and shoaling, river control works, modelling of fluvial processes.

## **CIVL9872**

Solid Waste Management Staff Contact: Mr SJ Moore CP12 SS Note/s: This subject is not offered every year.

Characterisation of municipal solid waste; collection; transfer stations; waste minimization and recycling; waste treatment, including size reduction, composting, incineration, emerging technologies; landfill disposal, including preparation of landfill management plans and operational aspects; introduction to planning of waste management systems.

## CIVL9875 Hydrological Processes Staff Contact: A/Prof II Cordery CP12 S1

Introduction to hydrological cycle and energy balance: meteorology; precipitation processes, interception and infiltration, storm runoff processes, groundwater flow, E-T.

## CIVL9876

## Water Resource Modelling Staff Contact: Dr A Sharma

CP12 S2

Water resources data sources, errors, corrections; introduction to storage-yield relationships for reservoir design; extension of records; stochastic models; stochastic reservoir analysis; deterministic catchment models; model calibration and verification; application of conjunctive use systems; social interactions-economics, politics, public participation.

## CIVL9880 Groundwater Modelling Staff Contact: Dr RI Acworth

CP12 S2

Groundwater modelling of porous media, fractured rock and low permeability material. Numerical modelling, including finite difference and finite element methods. Regional groundwater and multi phase fluid flow modelling. Software packages and applications to borefield management, saltwater intrusion, mine dewatering and site contamination.

## CIVL9881

Hazardous Waste Management Staff Contact: Mr SJ Moore CP12 SS

Note/s: This subject is not offered every year.

Waste audits and characterisation of hazardous wastes in regions and industries; control of generation and transport of hazardous waste, manifest systems; waste minimisation; on-site treatment methods; integrated off-site treatment facilities; management of residues from treatment facilities; introduction to planning of regional hazardous waste management systems. Characteristics of individual waste types (dioxins, PCBs, pesticides, heavy metal, etc.) and waste management in individual industries (steel, pulp and paper, petro-chemical, food processing, etc.).

## CIVL9885

Environmental Engineering Science 2 Staff Contact: Prof TD Waite CP12 S2

Classification of soils and improvement of the engineering properties of soils. Aspects of soil chemistry relevant to contaminant behaviour of soils. Fundamentals of dispersion common to all environmental media (air, water, soil). Air chemistry: interaction and degradation of gaseous pollutants in the atmosphere. Dispersion processes: nature of dispersion processes, advection and diffusion. Modelling of dispersion in the atmosphere, water bodies and soils.

## CIVL9888

Environmental Management Staff Contact: Mr SJ Moore CP12 S1

Spectrum of modern environmentalism and sustainable development; environmental impact statement techniques and EIA procedures; environmental management systems; tools for the analysis and management of environmental impacts of engineering projects, including environmental risk assessment, environmental and waste audits, Life Cycle Assessment and other materials accounting techniques.

## CIVL9889

Environmental Economics and Law Staff Contact: Mr SJ Moore CP12 S2

Introduction to economics of markets; sustainable development; pollution control; benefit-cost analysis; costing the environment. Regulatory procedures and requirements for new project development, and for the operation of facilities; including EIA and pollution control regulations with an emphasis on NSW.

#### CIVL9890 Spatial Decision Support Systems in Water Resources Staff Contact: Dr JE Ball CP12 SS

Note/s: This subject is not offered every year.

Principles of spatial decision support systems as used in hydrology, water resources and catchment management. Expert systems methods for decision modelling. Use of geographic information systems in surface and subsurface data analysis, model integration and presentation. Development and use of databases for water resources applications. Review of techniques for spatial data collection including remote sensing and global positioning systems.

## CIVL9891

Groundwater Contamination and Remediation Staff Contact: Dr RI Acworth CP12 S1

Description of types of groundwater contaminants, sources of groundwater contamination, review of transport equations, mass transport in saturated media, advection and dispersion, biological and chemical transformation of groundwater contaminants, multiphase flow, migration of nonaqueous phase liquids. Groundwater sampling and analysis, monitoring well design and installation, soil-water and soil-gas monitoring. Treatment and prevention of groundwater contamination. Site investigation methods at contaminated sites. Site remediation: source control, pump and treat, soil vapour extraction, bioremediation.

## CMED9500

Epidemiology Staff Contact: A/Prof J Kaldor

CP15 S1 HPW3

This subject provides students with an understanding of the role of epidemiology as the quantitative science underpinning much of public health practice. Students will learn the basic methodological tools of epidemiology, such as statistics to measure disease frequency, skills to critically review literature and interpret epidemiological studies, and their application in a variety of research and public health contexts. Skills for measuring frequency of disease and testing for evidence of association between risk factors and disease in this subject will build on statistics learnt in HEAL9061 Statistics for Public Health. This subject will cover topics pertaining to study design, basic statistical tests and interpretation of results. Application of these topics in areas such as questionnaire design, conducting and managing studies, problems relating to research grants will be covered in CMED9513 Applied Epidemiology.

## CMED9519

## Demography

Staff Contact: A/Prof I Burnley CP10 S2 HPW2

Introduction to demography; sources and processing of data, principles and applications. Life tables, mortality, marriage and divorce, natality, reproductivity. Martial characteristics and family groups. Migration. Distribution by area, sex, age, race; educational and economic characteristics. Population estimates and projections. Computer techniques.

## CMED9600

#### Disability

Staff Contact: Dr H Dickson CP10 S1 HPW2

Epidemiology of disabling physical and mental conditions; the nature of disability and handicap (including developmental disability); perceptions of handicap; disabled persons' consumer movement and organisation; 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 Tobacco, Alcohol and Other Drug Issues Staff Contact: A/Prof R Richmond CP10 S1 HPW2

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; media; specific intervention techniques for users of tobacco, alcohol and other drug use.

#### **CMED9609**

Community Genetics Staff Contact: Dr L Lai CP10 SS HPW2

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.

## **CMED9610**

## Community Nutrition and Food Policy Studies Staff Contact: Ms L Bloomfield and Ms P Craig CP10 S1 S2 HPW2

Introduction to nutrition and health; increasing interest in nutrition by population in general, epidemiological evidence of nutrition-related diseases and the increasing cost of treating these diseases, and common nutrition-related health disorders in the Australian community; various nutritional assessment techniques; nutrition information versus misinformation; location and utilisation of nutrition resources; recommendations about nutrition by instrumentalities such as the Health For All Taskforce and the Better Health Commission.

## CMED9612

Environmental Health

Staff Contact: Dr J Frith CP10 S2 HPW2 External mode also available Prerequisities: HEAL9061 Statisitics for Public Health

To introduce the principles of epidemiology, particularly in reference to environmental risk factors of disease and in reference to such principles as incidence and prevalence, aetiology and risk factors, epidemics and endemics, and primary, secondary and tertiary prevention of disease. In particular, it deals with environment and disease, radiation, chemical, hazards, air and water pollution, biological hazards, urban environment, ecology, ecosystems and interdependence and how these factors affect health, public health issues related to sustainable development.

## COMP9008

Software Engineering Staff Contact: Mr K Robinson CP15 S1 HPW4 Assumed knowledge: COMP9024 Note/s: Excluded COMP3111.

Informal specification: Data flow diagram methodology, analysis, design, testing, management and documentation of software. Formal specification: set theory, logic, schema calculus, case studies. The Z specification notation. Managing the project lifecycle. CASE tools. A major group project is undertaken.

## COMP9015

Issues in Computing Staff Contact: School Office CP15 S2 HPW3

A review of issues that affect the use of Computer Systems. Topics that may be covered include: the human implications of computing systems, the effect of computing operations on organisational structure, software copyright, privacy, the role of computing systems and information systems in decision making, the significance of the timeliness of information and its implication on the value of decision making and the requirements for a computing system.

## COMP9311

Data Base Systems Staff Contact: Prof J Hiller CP15 S1 or S2 HPW3 Assumed knowledge: Familiarity with storage structures

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, hierarchical/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; object data bases; data definitions; application generators.

## COMP9311

Data Base Systems

Staff Contact: Prof J Hiller CP15 S1 or S2 HPW3 Assumed knowledge: Familiarity with storage structures

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, hierarchical/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; object data

## ECOH2301

## Management and Business Development Staff Contact: Dr D Meredith

S1 HPW3 CP15 *Prerequisite:* ECON1102 **Note/s:** Not offered 1997.

## ECON1101

Microeconomics 1

Staff Contact: Dr G Otto

S1 or S2 HPW3 CP15

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 introduces economics as a social science: scarcity, resource allocation and opportunity cost; an introductory analysis of consumer behaviour; the economics of firms and markets; production and costs; the classification and analysis of markets; efficiency concepts and market failure; the gains from international trade and the impact of trade restrictions; economic growth and structural change.

## ECON1102

Macroeconomics 1 Staff Contact: Dr M Monadjemi S1 or S2 HPW3 CP15 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.

## ECON2101

Microeconomics 2 Staff Contact: Dr P Kriesler S1 HPW3 CP15 Prerequisite: ECON1101

This subject covers: choice theory, including intertemporal choice, and labour supply; extensions of price theory; the theory of production, costs and supply; market structures including oligopoly models; externalities; and provides an introduction to general equilibrium and welfare analysis.

## ECON2102

Macroeconomics 2 Staff Contact: Dr G Otto S2 HPW3 CP15 Prerequisite: ECON1102

This subject covers models of aggregate income determination in open economies; theories of aggregate economic behaviour with respect to consumption and investment expenditures and financial transactions; balance of payments and exchange rate analysis; theories of inflation and unemployment; introductory dynamic analysis; and theories of growth and cycles.

## ECON2103

Business and Government Staff Contact: A/Prof R Conlon S2 HPW3 CP15 Prerequisites: ECON1101 or ECON1103

This subject examines how government affects the business environment at the microeconomic level. The case for intervention and the benefits of deregulation and privatization are analyzed, with reference to particular industries. The effects on business of government instrumentalities such as the Industries Commission, Prices Surveillance Authority, Trade Practices Commission and Foreign Investment Review Board are examined. Issues relating to microeconomic reform, economic rationalism, market failure and government business enterprises are explored.

## ECON2104

Australian Macroeconomic Policy Staff Contact: Prof R Milbourne S1 HPW3 CP15 Prerequisites: ECON1102 or ECON1104

This subject examines economic growth and fluctuations and the effect this has on the business environment and the community. Explains the main macroeconomic tools and techniques used by governments and the Reserve Bank to implement fiscal, monetary and incomes policies. The implications for inflation, unemployment, interest rates and exchange rates, and foreign debt are discussed.

## ECON2109

Economics of Natural Resources Staff Contact: Dr C Alaouze S1 HPW3 CP15 Prerequisite: ECON2101 or ECON2103

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.

## ECON2111

The Economics of Global Interdependence Staff Contact: Dr P Robertson S2 HPW3 CP15 Prerequisite: ECON1102 or ECON1104

This subject loooks at Australia in an interdependent world; direction and composition of world trade;. trade in services; trade theory and trade policy; strategic trade policy and imperfect competition; international competitiveness; barriers to trade and trading blocs; international institutions and policy; NAFTA, GATT and EU; World Bank and IMF; foreign currency markets; and international policy coordination.

## ECON2115

## Japanese International Economic Relations

Staff Contact: Dr K Fox S2 HPW3 CP15 Prerequisite: ECON1102 or ECON1104

This subject considers: Japan's international trade, investment and balance of payments policies; globalisation of Japanese economic interests; problems relating to external economic policies including alternative strategies for international economic relations; impact of yen appreciation; trade friction; bilateral relations with focus on Australia, USA, China and South East Asia.

## ECON2116 Japanese Economic Policy Staff Contact: Dr K Fox S1 HPW3 CP15 Prereguisite: ECON1102 or ECON1104

This subject provides an analysis and evaluation of postwar economic policy: issues relating to policy determination including role of institutions and interest groups; critical examination of 'Japan Inc.' model; industrial policy and role of 'genkyoku' system; Japanese long term economic planning; nature of principle economic policies such as agricultural, monetary and fiscal; anti-trust and competition policies.

## ECON2117

Economics of Tourism Staff Contact: Dr G Waugh S1 HPW3 CP15 Prerequisite: ECON1102 or ECON1104

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 HPW3 CP15

Prerequisite: ECON1101 or ECON1103

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 Lodewijks S1 HPW3 CP15 Prerequisite: ECON1102 or ECON1104 Note/s: Not offered 1997.

## ECON1103

**Microeconomic Principles** 

Staff Contact: Dr J Lodewijks S1 HPW3 CP15

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.

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: Dr J Lodewijks S2 HPW3 CP15 Prerequisite: ECON1103 Note/s: Excluded 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.

## ECON5103

## Business Economics Staff Contact: A/Prof G Kingston S1 or S2 L3 CP20

An introduction to economic analysis and policy. Using a case study approach, students will examine government and business reports, magazine and newspaper articles, and monographs/journals dealing with contemporary economic issues. Reports or articles will be analysed using simple micro and macroeconomic tools and reasoning. The aim of the subject is to improve the economic literacy of students.

## ECON5116

## Environmental Economics Staff Contact: Dr G Waugh S2 L3 CP20 Prereauisite or Coreauisite: ECON5100

Main elements of environmental economics and cost benefit analysis as it relates to the assessment of environmental issues. Topics will 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.

## ECON5124

## Public Enterprise Economics And Cost-Benefit Analysis Staff Contact: Dr T Truong S1 HPW3 CP20 Prerequisite or Corequisite: ECON5100 Note/s: Not offered 1997.

The theory of public economic activity. Government objectives and the social welfare function. Equity and efficiency criteria. Public goods and externalities. The theory of public sector pricing and its applications. Techniques of investment appraisal, cost-benefit analysis and related issues. The application of cost-benefit analysis to transport, urban and other problems. Analysis of transfer policy

## ECON5248

Business Forecasting Staff Contact: Dr J Murray S1 L3 CP20 Prereguisite: ECON5203

This subject looks at the use of econometric and statistical techniques relevant to forecasting in a business environment and computer implementation of the methods. Short-term forecasting using time series analysis,

long-term forecasting with S-shaped growth curves and trend analysis. The study of applied work is emphasised in this non-specialist course.

## ELEC0807

Electrical Engineering 1E Staff Contact: Dr BD Farah CP7.5 S2 L2 T1 Prerequisite: PHYS1002, PHYS1919 or equivalent

Fundamental concepts in electrical circuits: key theorems, analysis of AC circuits, complex impedance, RLC circuits. Introduction to amplifiers and filters. Functional circuits based on operational amplifiers. Introduction to digital logic, based on integrated circuits. Combinational logic and memory., Electric machines: DC and AC motors. Characteristics of principle types and their applications.

## ELEC0808

Electrical Engineering 2E Staff Contact: Dr BD Farah CP7.5 S2 L2 T1 Prerequisite: ELEC0807

Signal processing using integrated operational amplifiers, passive components and selected non-linear elements. Processing data from typical industrial sensors. Digital logic: registers, adders. Serial and parallel data transmission. A/D converters. The architecture of a micorporcessor and an outline of programmed control. Transformers and power supplies. Dynamic characteristics of AC and DC motors. Speed control and principles of servo design.

## FINS2613

Business Finance Staff Contact: School Office S1 or S2 L2 T1 CP15 Prerequisites: FINS2612 or any two of ACCT1511, ECON1102 and ECON1203

This subject 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; and influence of the capital market environment.

## FINS5511

Corporate Finance Staff Contact: School Office S2 L3 CP20 Prerequisites: ACCT5901 and ECON5103 and ECON5203

Essential aspects of financial decision-making in business. Designed to enable the student to usefully employ the following concepts in a business environment: investment decisions under uncertainty; cost of capital structure; mergers and takeovers; and working capital management.

## FINS5512

**Australian Capital Markets** 

Staff Contact: School Office S1 or S2 L3 CP20

Prerequisites: ECON5103 and ECON5203

Analysis of the markets for the financial assets including the money, bond, stock and futures markets; the structure of interest rates; flow of funds of financial institutions; the regulatory structure of markets and the interrelations among markets.

## FINS5513

Security Valuation and Portfolio Selection Staff Contact: School Office

S1 or S2 L3 CP20 Prerequisites: ECON5103 and ECON5203

The aim of this subject is twofold: (i) to introduce students to theoretical building blocks in the theory of finance; and (ii) to illustrate these by means of a combination of tutorial problems and case studies. Topics include: investment decisions under certainty; investment decisions under uncertainty (the portfolio selection problem); capital asset pricing model and arbitrage pricing theory: rudiments of theory and evidence; fundamentals of bond valuation; introduction to duration and the term structure of interest rates; valuation of equity shares; market efficiency: fads, bubbles, martingales.

## GMAT0441

**Surveying for Engineers** 

Staff Contact: A/Prof A Stolz, Dr BR Harvey CP11.5 S2 L2 T2.5 Note/s: This is a servicing subject taught within

**Note/s:** This is a servicing subject taught within courses offered by other schools and faculties.

Principles of surveying; co-ordinate systems, levelling, linear and angular measurement. Traversing, tacheometry and electronic distance measurement. Areas and Volumes. Horizontal and vertical curves. Control, underground and construction surveys. Outline of photogrammetry.

## **GMAT6532**

Spatial Information Systems 1 Staff Contact: Dr EG Masters CP7.5 S2 L2 T1 Corequisite: GMAT5122

Overview and background of Spatial Information Systems. Explanation of definitions and terminology. Theory and application of SIS technology; digital maps and data base management; data acquisition; data storage, editing, raster and vector representations; topology. Modelling and analysis. Design and development of spatial databases. Use of GIS packages.

#### GMAT9211

Introduction to Geodesy Staff Contact: A/Prof A Stolz CP12 S2 L2 T1

Geodesy in the service of mankind. The earth's gravity field. The earth's motion in space. Co-ordinate and time systems used in geodesy. Horizontal and vertical control networks. Earth satellite motion. Principles of satellite positioning. Gravimetric geodesy. Space geodetic methods. Variations of geodetic positions with time.

## GMAT9212

GPS Surveying Staff Contact: A/Prof C Rizos CP12 S1 L2 T1

Introduction to GPS, satellite positioning, the GPS system, field planning and office procedures, GPS instrumentation, modelling, GPS observables, introduction to data processing, use of software, ambiguity resolution, modern GPS surveying techniques, baseline adjustment within networks, transformations, height determination. Tutorials and field exercises will focus on mathematical modelling issues, understanding GPS performance using commercial hardware/software systems.

## GMAT9530 Analytical Photogrammetry

Staff Contact: Prof JC Trinder CP12 SS L2 T1

Fundamental relationship, image and object space. Interior orientation, deviations from collinearity. General orientation of one and two images by collinearity. Simultaneous block adjustment by bundles. Additional parameters. Calibration of metric and non-metric cameras. Control requirements in analytical photogrammetry.

## **GMAT9532**

## Data Acquisition and Terrain Modelling Staff Contact: Prof JC Trinder

Introduction to principles of Computer Assisted Mapping. Collection and editing of feature coded digital terrain data

collection and editing of leatine coded ugital terain data in vector and raster form. Digital elevation models; acquisition, interpolation and processing. Terrain modelling and display. Automation of mapping processes. Archival of digital map data.

## **GMAT9600**

Principles of Remote Sensing Staff Contact: Prof BC Forster CP12 S1 L2 T1

History and development. Definition and physics of basic electromagnetic radiation quantities. Basic-energy matter relationship. Spectral signatures of surfaces. Atmospheric considerations and the reduction of atmospheric effects. Sensor concepts including film and electro-optical sensors. An introduction to data processing and enhancement, including image interpretation procedures.

## GMAT9604

Land Information Systems Staff Contact: Dr EG Masters CP12 SS L2 T1

Land information as maps and records. Methods of data collection. Integrated surveys and coordinate systems. Legal boundaries. Land tenure. Identifiers. Computerisation of land information. Data input methods. Data storage methods. Data processing and manipulation, including management, searching, existing data base languages, and interactive data editing. Data output, including computer graphics, line printer maps, and digital plotters. Application of Arc-Info LIS software.

## **GMAT9605**

Field Data Collection and Integration Staff Contact: Prof BC Forster

CP12 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.

## GMAT9606

Microwave Remote Sensing Staff Contact: Prof BC Forster CP12 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.

## HEAL9371

Research and Evaluation Methods Staff Contact: Dr Mary-Louise McLaws CP15 S1 (HK only) S2 L2 Prerequisite: HEAL9411 Epidemiology for Health Administrators and Planners or CMED9500 Epidemiology.

Special problems of health services research and evaluation; identifying research areas; reviewing the literature; statements of objectives and formulation of hypotheses; experimental and quasiexperimental designs; nonexperimental models; sample selection; questionnaire design and problems of measurement; introduction to analysis of data; methods of presenting findings; reliability of research evidence; research ethics; research and decisionmaking; policy issues.

## HEAL9411

## Epidemiology for Health Administrators and Planners

## Staff Contact: Dr Mary-Louise McLaws CP15 S1 L2

Principles and methods of epidemiologic investigation of both communicable and noncommunicable diseases including descriptive, analytic and experimental epidemiology. The epidemiology of acute chronic diseases, demography, determination of health status of a defined population, measurement of disease rates & interpretaton. The uses of epidemiology in planning, operation and evaluation of interventions. Epidemiology of staff, hospital services, diagnostic & treatment services.

## HEAL9421

## Public Health Staff Contact: Prof James Lawson CP15 S1 L2

Distribution patterns and determinants of disease and disability with particular reference to diseases of major Australian concern. Preventive, treatment and rehabilitation strategies. The uses of epidemiology in the planning, operation and evaluation of health services.

## INFS1602

## Computer Information Systems 1 Staff Contact: School Office

S1 or S2 HPW 3 CP15

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 organisational level, typical commercial applications, the systems life cycle, design concepts, data analysis and models and an introduction to data communications.

## INFS2603

Systems Analysis and Design Staff Contact: School Office S2 HPW 3 CP15 Prerequisites: INFS1603

This subject examines system analysis and design: requirements analysis and specification; logical and physical design of business systems; students compare design methodologies such as structures and object oriented.

## INFS2607

**Business Data Networks** Staff Contact: School Office S2 HPW 3 CP15 Prereauisite: INFS1602 Note/s: Excluded INFS3607. Replaced INFS3607 in 1996.

Data communication concepts and computer networks, reference to international standards and common industry communications software packages; local/metropolitan/wide area networks; network management; Telstra services and other options; data security.

## **INFS3603**

**Executive Support Systems** Staff Contact: School Office S1 HPW 3 CP15 Prerequisites: INFS1602 and INFS1603

This subject examines the process of decision making and work group activity by professional and managerial people: the tools and techniques available in information technology to support these processes; the cultural and organisational issues involved in formalizing support; and management issues related to support.

## **INFS3604**

Information Function Management Staff Contact: School Office S2 HPW 3 CP15 Prereauisite: INFS2603

This subject introduces the strategic and operational management issues involving information systems and software. Consideration is given to both quantitative management techniques, including practical application of tools and concepts for software project management, as well as material on software metrics and software quality. In addition, techniques are covered for strategic planning of information systems and ensuring business contribution.

#### **INFS3608**

Advanced Database Systems Staff Contact: School Office S1 HPW 3 CP15 Prerequisites: INFS1602 and INFS1603

Topics include: advanced data analysis and modelling techniques; database management system architectures including hierarchical, network and relational approaches; database reliability, security and integrity issues; and data description and manipulation languages.

## **INFS5848**

Information Systems Project Management Staff Contact: School Office S2 L3 CP20 Prerequisite: INFS5988

An introduction to the central concepts and issues of project management and the practical benefits of project planning and management together with resource management. Practical sessions in project planning and the use of a computer based management tool. Additional topics include customer focus, lifecycle customization, work packages, progress monitoring, risk evaluation, quality management, people skills, and negotiation skills. Case studies of and examples from software development projects wil be used as illustrations.

## INFS5928 Software Engineering Management Staff Contact: School Office S1 L3 CP20 Prerequisite: INFS5988

Software engineering management and measurement of complex systems, software development maturity, project planning and management, estimation models and techniques, project scheduling, software quality, reliability, assurance, software productivity models. The teaching mode is a mix of formal lectures, seminars and workshops with an emphasis on co-operative discussions.

#### INFS5953

## Information Systems Management

Staff Contact: School Office S2 L3 CP20 Prerequisites: INFS5988 and INFS5992

This subject aims to assist students to develop their knowledge and understanding of important issues involved in the management of information systems in organisations and their ability to critically analyse these issues. Management of information systems will be considered at strategic, tactical and operational levels. Particular emphasis will be given to the management of enterprise-wide and inter-organisational systems and planning for their strategic use. Students without knowledge of and experience in management or the use of IS in organisations may wish to take the subject INFS4848/INFS5848 before this subjects.

#### **INFS5957**

#### Information and Decision Technology Staff Contact: School Office S1 L3 CP20

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.

#### **INFS5983**

## **Business Data Communications**

Staff Contact: School Office S2 L3 CP20 Prerequisite: INFS5988

Data communication networks; interfaces between networks and computers, data communications software, standard communication protocols, network architectures, distributed databases, design of information systems which include data communications.

#### **INFS5988**

**Business Information Systems** Staff Contact: School Office S1 L3 CP20

This subject aims to provide an introduction to the use and management of information systems in business. This subject will assist students to develop their knowledge and understanding of the role of information systems in business organisations, and components and disciplines which comprise information systems. This subject will also assist students to develop their capabilities to critically apply the disciplines of information systems and to use application software in support of typical managerial tasks. Application software will include word processing, spreadsheets and personal databases.

## **INFS5989**

Information Systems Design Staff Contact: School Office S2 L3 CP20 Prerequisite: INFS5988

An understanding of the role and expectations of a systems analyst in the context of the organisational environment, exploring and using the tools and techniques available to the systems designer, expanding and building on the framework of analysis and design acquired from the other subjects and student experiences.

#### **INFS5991**

Decision Support Systems

Staff Contact: School Office S1 L3 CP20 Prerequisite: INFS5988

Information used for decision making and the application of information technology to assist or support the decision making process. Topics include decision making models, the impact of different management styles, the use of decision tools and the development of decision support systems including issues of model management and interface design. Practical examples of decision support systems are examined as are executive information systems and computer mediated communications within an organisation.

INFS5992 Data Management Staff Contact: School Office S1 L3 CP20

A review of data management principles including both simple and complex file designs, and the concept of database management systems. Alternative database management system architectures, including network hierarchical and relational approaches. Database query systems, including relational algebra. Case studies and assignments embodying these principles.

## IROB2721

Managing People Staff Contact: Dr A Donovan S1 L2 T2 CP15

This subject focuses on managing in a rapidly changing environment. Topics include: leadership, decision-making and innovation; power, legitimacy, and the socialization process; the structure and design of organisations, organisation and domination, the evolution of ethical awareness; intergroup conflict and conflict resolution; skills of managing communication, negotiation, coaching and objectives setting; organisational culture and transformation.

## IROB5701

Australian Industrial Relations Staff Contact: A/Prof B Dabscheck S1 L3 CP20

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.

## IROB5702

Industrial Relations in the Global Economy Staff Contact: Dr I Hampson S2 L3 CP20 Prerequisite: IROB5701

This subject focuses on the 'global shifts' in economics and industry that are driving transformations in many national IR systems. As such the subject shares many of the objectives of comparative IR, namely to foster an appreciation of the merits of comparing IR systems, and the use of comparative method. Since one of the major uses of comparative arguments is in the sphere of industrial relations policy, the subject also aims to review debates about the links between IR systems on the one hand, and national competitiveness and social protection on the other.

## IROB5711

Employment and Industrial Law Staff Contact: School Office S1 L3 CP20 Prerequisites: IROB5701 or equivalent

Nature and purposes of the legal system and industrial law, the law concerning the contract of employment. Trade union law. Industrial law powers of governments. The Commonwealth and New South Wales conciliation and arbitration systems. Awards. Penal sanctions for industrial law. Industrial torts. Topics and issues of importance in the employment and industrial law field.

## IROB5712

Negotiations, Bargaining and Advocacy Staff Contact: Ms S Hammond S2 L3 CP20 Prerequisite: IROB5701 or equivalent

This subject aims to give students studying industrial relations and/or human resource management practical skills in the areas of industrial and workplace negotiation, bargaining and advocacy. The subject examines the content, character and making of industrial awards and agreements, with special emphasis on industrial tribunal processes and negotiation and advocacy in relation to paid employment. Students also receive a practical grounding in the requirements of particular policies and regulations governing employment relations, including Enterprise Bargaining, Equal Opportunity and Affirmative Action, Occupational Health and Safety, and Termination of Employment. In addition, the subject provides appropriate theoretical perspectives on these and related employment issues.

## **IROB5713**

Public Policy and Employment Staff Contact: A/Prof B Dabscheck S2 L3 CP20 Prerequisite: IROB5701 or equivalent

The formulation and implementation of public policy impacting upon industrial relations and employment. Theories of the state; public policy models. Current policy issues and options. The interaction between tribunals, parties and public policy evaluation of policy process in Australian and comparative terms. Case studies.

## **IROB5900**

Social and Organisational Analysis Staff Contact: School Office SS L3

This subject examines the core concepts and theories underlying modern organisational practice, drawing principally from the discipline of sociology. Topics covered include the evolution and development of social and organisational theory, sociological paradigms and implications for organisational analysis, bureaucracy, organisational design and development, and current topics such as regulation and privatisation, participative democracy and the future of Australian manufacturing industry. A practical focus is maintained through the use of Australian case studies.

## IROB5901

Organisational Behaviour Staff Contact: Mr J Holt S1 or S2 L3 CP20 Note/s: Excluded PSYC7100.

This subject seeks to explain human behaviour within organisations. It draws predominantly from the behavioural science disciplines of psychology and social psychology. Its foci are the individual, the group, and the behavioural processes involved in organisation integration, change and development. Topics covered include personality, attitudes and values, motivation and learning, interpersonal behaviour, group dynamics, leadership and teamwork, decision-making, power and control.

## **IROB5903**

Organisational Change and Development Staff Contact: Dr A Bordow S1 L3 CP20 Prerequisite: IROB5901 or IROB5701

The theory and practice of change in organisations with special attention to applied behavioural science methods for achieving sustained improvement in performance at the individual, group and system levels. Methods and topics examined include: diagnostic approaches, organisational culture and change, action research, organisational learning, strategic planning for change, organisational transitions, structural redesign, teambuilding and skills of change agent intervention.

## **IROB5904**

Corporate, Management and Union Strategy Staff Contact: School Office S2 L3 CP20 Prerequisite: IROB5901 or equivalent

This subject deals with theories of strategy, strategic planning and implementation, and the concept and exercise of strategic choice. It is distinguished from conventional managerial approaches to strategic planning by its application to labour-management-relations and by its inclusion of trade union strategies. For both organised labour and for management, the management of strategy is a particular focus of the subject.

## **IROB5906**

## Human Resource Management in Context Staff Contact: Dr L Taksa

S1 L3 CP20

Theories of organisational behaviour and management will be examined in order to locate Human Resource Management in historical, conceptual and practical contexts. Changing factors that shape the organisation of work, worker and managerial responses and action will be considered with specific focus on their relationship to power, conflict, control, motivation, group interaction and culture. The role of Human Resource Management in the implementation of organisational change will be included.

## **IROB5907**

## Human Resource Management Processes Staff Contact: Dr L Taksa

S2 L3 CP20 Prerequisite: IROB5906

Prerequisite: IROB5906 or IROB5701 or IROB5901 or equivalent

Theoretical foundations of Human Resource Management; power and authority of HRM function. Examination of policies and strategies developed by employers to organise and reward their employees. Values underlying such policies; controversies surrounding their development and implementation; the way in which organisational dynamics influence their operation. The interface between HRM policies and the regulatory, social and organisational contexts; the operation of HRM policies in different business sectors and countries.

#### IROB5912

## International Dimensions of Organisational Behaviour

Staff Contact: Mr J Holt S2 L3 CP20 Prerequisite: IROB5901 or equivalent

This subject provides a comparative focus to the study of organisations in global context by exploring how organisation, management and employment systems differ across cultural frameworks. The effects of culture on the structure of national organisational systems, corporate transnational systems, and international HRM are also examined. Other topics include the transferability of management systems and techno-cultures across cultural boundaries, and the 'convergence versus divergence' thesis. Where possible, case studies contrasting Asian with Australian perspectives are used.

## IROB5914

## **Employee Communications**

Staff Contact: Dr A Bordow S1 L3 CP20 Prereguisite: IROB5901 or equivalent

This subject provides for an understanding of how human communication works within organisational domains and especially examines communication as an influence process. The basics of interpersonal, organisational and mass communication together with public relations will be reviewed in order to proceed to the study of such applications as communicating to employees en masse, effecting appropriate media choice, informing stakeholders and interested publics, and developing a corporate information policy. All students will take part in a learning augmentation, called a virtual class room, to enhance their awareness of a new communications technology and will carry out a field investigation within an ongoing organisation.

## IROB5915

Human Potentialities Staff Contact: Dr A Donovan S2 L3 CP20 Prerequisite or Corequisite: IROB5901 or equivalent

This subject follows an empirical and experiential approach to the study of human potentialities. Issues explored include: human dominance and destructiveness; the dynamics of awareness; intentionality and holonomy; skilled performance; human creativity; the individuation process; methods of realizing potential, perennial and modern.

## IROB5920

Men and Women in Organisations Staff Contact: Dr L Taksa S2 L3 CP20

This subject presents a multi-disciplinary overview of the issues and problems pertaining to gender relations in organisations. It evaluates a range of concepts and methods necessary for understanding the processes and structures responsible for the current position of men and women as employees and managers in both the public and private sectors. Topics covered from the perspective of gender relations include: labour market segmentation, industrial relations theory and practice, the role of the state, organisational power and politics, Equal Employment Opportunities and the functioning of the merit principle and the use of post-modernist theory for understanding the operation of human resource management and organisational culture.

## IROB5921

#### Management in Cross-Cultural Contexts Staff Contact: School Office SS L3 CP20

This subject examines how the dynamics of culture impact on the process of managing organisations in culturally diverse settings. Topics include: conceptual and methodological issues related to the study of culture; the psychological and sociological basis of cultural variation; the role of culture in shaping work-related cognitions; the problematics and implications of cultural variation for the functions of cross-cultural management such as inter-cultural communication; cross-cultural leadership; cross-cultural negotiation; and cross-cultural awareness. Other issues such as transferability and the convergence and divergence thesis are also addressed.

## IROB5947

Performance Management Staff Contact: School Office SS L3 CP20 Prerequisite: IROB5900

The subject focuses on the coordination and execution of organisational work tasks. It covers the relation between organisational strategy and the purposes of separate units, setting objectives, formal monitoring and performance evaluation, appraisal systems and job design, performance related pay and renumeration. Critical issues centred on managing equity, affirmation action and equal opportunity and the role of social and work norms in performance are covered.

## IROB5948

Human Resources Development Staff Contact: School Office SS L3 CP20 Prerequisite: IROB5900

This subject focuses on the skills, career and occupational development of people in organisations. Human resource planning, gap analysis of supply and demand, training, needs analysis, learning systems, program development, internal and external training policy, career planning and internal labour markets are key topics in the subject. Recruitment and selection, management development, employee contribution and trade union involvement are among other areas addressed.

## LAND9111

#### Landscape Planning Staff Contact: Mr D Crawford

CP12 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.

## LAND9212

## Landscape Planning Methods Staff Contact: Mr D Crawford

CP12 S2 L2 T1

Examination and comparison of a range of landscape planning methods using examples from Australia and overseas. Students conduct research relating to the physical parameters of models for land use evaluation and environmental impact assessment. Participation in planning exercises involving the application of these models using advanced computing techniques.

## LAND9213

## Land Systems and Management Staff Contact: Ms A Todd

CP12 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.

## LAND9214

Visual Landscape Assessment Staff Contact: A/Prof F Thorvaldson CP12 S2 L2 T1

Examination of visual analysis, assessment and evaluation techniques and their incorporation into landscape planning models. Research and study of recent Australian and

overseas examples of visual resource management programs. Students will undertake visual planning exercises using relevant computer software.

## LAND9215

GIS in Landscape Architecture Staff Contact: Mr D Crawford CP15 S1 L2T1

Principles of geographic information systems, techniques of data collection, storage analysis, modelling and display. Applications and procedures specific to Landscape Architecture and Landscape Planning. Laboratory exercises using the IDRISI GIS.

## LAWS3409

Environmental Law and Policy Staff Contact: School Office CP30 F HPW2

This subject examines environmental law in Australia in a policy setting. Environmental law is interpreted broadly to refer to all relevant regulatory frameworks, including both statutory and common law ones, as well as relevant international administrative and legal arrangements. The primary focus will be the NSW context, but environmental issues of a global, regional and national nature will also be addressed. The law will be examined in an inter-disciplinary way, referring to economic, sociological, historical and philosophical analysis, with reference being also made to comparative environmental law. Particular topics of a conceptual kind include: how environmental problems are defined and what form they take; competing values (e.g. anthropocentric versus ecocentric perspectives) and how such values are articulated (through, e.g., public participation) in order to develop public policy responses to environmental problems; and theoretical aspects of policy development and evaluation, referring to cost-benefit analysis and risk assessment, spillover effects, the nature of public goods, and issues of justice in the distribution of environmental costs and benefits. Consideration of legal techniques for giving effect to environmental policies will cover such matters as: property law, including private and common property rights, conservation covenants, heritage agreements; tort law; forward planning and the planmaking process; project control; environmental impact assessment: pollution control; self-regulatory measures; and issues of enforcement. Alternatives to legal regulation for the achievement of

## LAWS3410 Environmental Law Staff Contact: School Office CP15 SS HPW4

This subject examines environmental law in both a theoretical and a practical sense. From the theoretical point of view, environmental law is considered through interdisciplinary perspectives in a policy setting. The non-legal perspectives in terms of which environmental law is considered include ecology, economics and philosophy. The practical orientation of the course is toward developing an understanding of the legal framework for environmental decision making in Australia, particularly in N.S.W. Topics to be covered include the relevance of ecology to environmental law, environmental ethics, international environmental law, Commonwealth powers with respect to the environment, a range of Commonwealth and NSW legislation relating to the environment, and different legal

techniques for enhancing protection of the environment (eg. regulation through the criminal law, through traditional common law techniques such as nuisance and private covenants, through economic incentive schemes, and through systems of consents and licenses). Litigation and alternative dispute resolution techniques are examined. Attention is also given to: (1) the part played by political and administrative discretion in the field of environmental decision-making, with some emphasis on the tensions which exist between various levels and bodies of government; (2) the role of public participation in the decision making process; and (3) environmental law in other countries, particularly the U.S. Students are encouraged to take an interest in topical environmental issues.

## LAWS5020

Occupational Health and Safety Law Staff Contact: Prof Adrian Brooks CP15 SS HPW4

The law relating to compensation for work-related injuries and disabilities and to the regulation of safety standards in workplaces. Topics include: the employer's common law duty of care; the common law duty of care of manufacturers of products for use at work; the development and application of workers' compensation schemes; existing protective legislation in Australia; individual rights under protective legislation.

## LEGT5511

Legal Foundations of Business Staff Contact: School Office

S1 or S2 L3 CP20

Law is an important foundation of modern business decisions. In any business decision fundamental legal questions may arise about the potential liabilities of the parties, the rights that the parties have and how the business or transaction should be organised. This subject introduces the Australian legal system; outlines alternative forms of business organisation; discusses the legal framework of business regulation; and examines areas of law particularly relevant to business such as the law of contract, law relating to specialised commercial transactions, the regulation of restrictive trade practices and sales promotion.

## LEGT5531

Legal Regulation of Business

Staff Contact: School Office S2 L3 CP20

*Prerequisite:* LEGT5511 or equivalent or approval from the Head of School

Trade practices and fair trading laws have assumed fundamental importance in the Australian market place. This subject examines the regulation of restrictive trade practices under the Trade Practices Act 1974 (Commonwealth) and the Competition Code with particular reference to collusive activity, distribution methods, pricing arrangements, abuse of market power, mergers and access to essential facilities. This subject also examines major fair trading initiatives under the Trade Practices Act and State and Territory Fair Trading legislation with particular reference to misleading or deceptive conduct, unconscionable conduct, advertising and marketing strategies and product liability. Aspects of the protection of intellectual property are also examined.

## LEGT5541

Company Law Staff Contact: School Office S1 L3 CP20 Prerequisite: LEGT5511 or equivalent or approval from the Head of School

The law relating to business organisations, including partnerships, joint ventures, trading trusts, and companies incorporated under the Corporations Law . The primary focus is on company law and, in particular, the significance of the corporate entity; groups of companies, the division of corporate control amongst directors, management and shareholders and their respective roles, the duties of directors, share and debt capital, funding raising, enforcement of shareholders' rights, insolvency and liquidation.

## LEGT5551

Revenue Law

Staff Contact: School Office S2 L3 CP20 Prerequisite: LEGT5511 or equivalent or Approval from the Head of School

A series of major changes beginning in the mid 1980s have transformed the Australian tax system. The complexity and comprehensiveness of the Australian tax system now mean that tax considerations now are of major importance in most business decisions. After outlining tax policy, tax mix and tax reform, considerations, this subject concentrates on income taxation in Australia. Topics include: concepts of income; allowable deductions; tax accounting; taxation of partnerships; trusts and corporations; anti-avoidance provisions; tax administration; capital gains tax; and fringe benefits tax.

## LEGT5561

Legal Aspects of Finance Staff Contact: School Office S1 L3 CP20

Commercial structures including companies, joint ventures, partnerships and trusts. Procedures for equity and debt financing of entrepreneurial schemes with special reference to both law and practice. The regulation of the securities market. Corporate restructuring and take-overs, mergers and reconstructions. The law of company charges. Aspects of the taxation of commercial financing.

## LEGT5562

Business Law in a Global Economy Staff Contact: School Office S1 L3 CP20

Developments in technology, telecommunication and deregulation which have taken place in the latter part of this century have led to the creation of a global economy. This subject addresses the legal environment of this economy and aspects of its operation. Topics include the laws and practices relating to international sales agreements; arrangements for conducting business, including franchising; licensing, joint ventures and technology transfer; international financing arrangements; and the resolution of disputes.

## LEGT5571 Franchising

Staff Contact: School Office S1 L3 CP20

Franchising is becoming the dominant force in the distribution of goods and services. This subject examines the nature, development and significance of franchising in the Australian and international economies and addresses relevant legal and commercial issues. The legal nature and commercial implications of other distribution strategies - technology transfers, trademark licensing, character and personality merchandising are also examined.

## LEGT7711

## Legal Environment of Commerce

Staff Contact: School Office

S1 or S2 L2 T1 CP15

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)

The entire fabric of commerce is woven from a complex legal regime, judicial and statutory, which regulates all commercial activity. This subject deals with the Australian legal system; Commonwealth/State relations; Parliament and statute law; the courts and case law; the executive and administrative law; the legal process and its alternatives. This subject also introduces areas of substantive law relevant to commerce with particular reference to property law (with particular reference to intellectual property), torts law (with particular reference to negligence), contract law, criminal law, commercial entities and transactions, competition and consumer protection.

## LEGT7731

#### Marketing and Distribution Law Staff Contact: School Office S1 or S2 L2 T1 CP15

The marketing and distribution of goods and services operates within a comprehensive regulatory framework. This subject examines that framework. Topics include restrictive trade practices implications of distribution with special reference to collusive activity, exclusive dealing, resale price maintenance and abuse of market power; consumer protection and fair trading implications of sales promotion with particular reference to misleading or deceptive conduct and other unfair practices; advertising self regulation; product liability; protection of intellectual property; franchising, licensing and character merchandising.

## MANF0420

Production Management Staff Contact: Dr K Hoang CP15 S1 HPW6 Note/s: Excluded MANF4420.

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.

## **MANF9400**

Industrial Management Staff Contact: Dr B Kayis CP12 SS HPW3

Evolution of management thought, the planning process; nature of managerial decision making, organisational structures; managing organisational change, motivation, performance, satisfaction, interpersonal and organisational communication, use of management information systems.

## MANF9410

Total Quality Management Staff Contact: Dr B Kayis

CP12 SS HPW3

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.

## MANF9470

Production Management 1 Staff Contact: A/Prof RM Kerr CP12 SS HPW3

Dynamics of industry competitiveness: Porter's Model; waste elimination and value adding management; material flow dynamics; production planning and control techniques including MRP, OPT and JIT; maintenance management; purchasing; physical distribution; manufacturing strategy and performance monitoring.

## MANF9601

#### Economic Decisions in Industrial Management Staff Contact: Mr M Hasan CP12 SS HPW3

Concept of economic analyses. Cost concepts; interest and interest formulae. Methods for economy studies; present work, annual worth, payback period and rate of return; comparing alternative investments; depreciation methods, effect of income taxes, inflation; replacement analysis; capital budgeting; break-even and sensitivity analyses; economic decision making under risk and uncertainty; evaluation of projects in public sector.

## **MARK2012**

Marketing Fundamentals Staff Contact: School Office S1 or S2 L2 T2 CP15 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 S1 or S2 L2 T2 CP15 Prerequisite: MARK2012, MARK2032

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.

## MARK3043

International Marketing Staff Contact: School Office S2 L2 T1 CP15 Prerequisites: MARK2042 or MARK2052

Conceptual and environmental aspects of international marketing are dealt with. Using this knowledge, issues associated with developing practical marketing strategies appropriate to different world markets are then considered in detail.

## MARK3073

Brand Management Staff Contact: School Office S1 L2 T2 CP15 Prerequisite: MARK2012, MARK2042

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.

## **MARK3083**

Strategic Marketing Management Staff Contact: School Office S2 L2 T2 CP15 Prerequisite: MARK3073

Concepts introduced in previous subjects will be broadened to address issues at the business unit level. Corporate mission, competitive stance of the organisation, pricing policies, trade relations, internal marketing and logistics will be addressed. The management of organisational resources such as financial and human resources are considered using, for example, portfolio analysis. Decision support systems are also examined.

## MARK3093

Corporate Policy and Marketing Strategy Staff Contact: School Office S2 L2 T2 CP15 Prerequisite: MARK3073

The interface between marketing and other key functional areas within the organisation, such as finance, human resources and manufacturing are examined. Marketing's interface with areas outside the organisation, such as strategic alliances, joint ventures and partnership in global markets are also examined. Social, ethical, technological, legal and global issues are addressed. Case analysis will be used. MARK5902 Elements of Marketing Staff Contact: School Office S1 + S2 L3 CP20 Prereguisite or coreguisite: one core unit

The course is a blend of theory and practical application. The central theme running throughout the teaching program is that marketing is not a fragmented assortment of actions and functions taking place among disconnected institutions operating in isolation. Rather it is a total system of business action. The task of managing a marketing operation involves strategic and tactical decision making. It also demands an understanding of the structure of the marketing system, the various institutions that make up that system, and the role of each institutions that make up that

## **MARK5903**

International Marketing Staff Contact: School Office S1 L3 CP20 Prerequisites: MARK5902, MARK5911 Prerequisite or Corequisite: MARK5928

Character and dimension of the political, economic, modernization (including administrative) and social aspects affecting international marketing; the dynamic relationship between the environmental aspects and international domestic marketing. Operational aspects of international marketing; nature of competition marketing structure and channels, trade barriers, etc., as well as international, regional, sub-regional economic groupings with emphasis on marketing in Asia, particularly Japan.

## **MARK5929**

## **Corporate and Marketing Planning and Policy**

Staff Contact: School Office S2 L3 CP20 Prerequisites: MARK5902, MARK5911 and MARK5928

Examines the evolution of marketing systems and relation of the organisation to the social and economic environment. Key topics include growth options; developing competitive strategies and managing change. Central to the subject case analyses of marketing planning and policy, including environmental appraisal, organisational response, product policy, pricing, distribution, promotion and issues relating to consumerism and the development of legislation. Examples are drawn from the public and the private sectors.

## MARK5930 Managerial Elements of Marketing Staff Contact: School Office S2 L3 CP20 Prerequisites: MARK5902, MARK5911 and MARK5928

Managerial elements of marketing is a unit that brings together a number of managerial components. While three dominant themes are usually present; sales planning and business-to-business negotiation, and legal aspects of marketing, other topics may be included, or may even replace one of the dominant themes completely to take advantage of the skills of visiting scholars. Students contemplating undertaking this subject should note that it includes a one-day negotiation workshop run on a weekend and is mandatory part of the course.

## MARK2012 Marketing Fundamentals

Staff Contact: School of Marketing Office CP15 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.

## MATH1011

## **General Mathematics 1B**

Staff Contact: School of Mathematics First Year Office CP15 S1 HPW6

*Prerequisites*: HSC mark range required: 2 unit Mathematics (60-100) or 2 and 3 unit Mathematics (1-150) or 3 and 4 unit Mathematics (1-200) (these ranges may vary from year to year). 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.

Note/s: Excluded MATH1032, MATH1042, MATH1131, MATH1141, ECON1202, ECON2200, ECON2201, ECON2202, ECON2290, ECON2291.

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 CP15 S2 HPW6

*Prerequisite:* MATH1011 or MATH1131 or MATH1141 **Note/s:** Excluded MATH1032, MATH1042, MATH1231, MATH1241, ECON2200, ECON2201, ECON2202, ECON1202, ECON2290, ECON2291.

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.

## MATH1131

#### Mathematics 1A

## Staff Contact: School of Mathematics First Year Office CP15 S1 or S2 HPW6

*Prerequisites:* HSC mark range required: 2 unit Mathematics (90-100) or 2 and 3 unit Mathematics (100-150) or 3 and 4 unit Mathematics (100-200) or MATH1011 (these ranges may vary from year to year). 2 unit Mathematics in this instance refers to the 2 unit Mathematics subject which is related to the 3 unit Mathematics in Society or Mathematics in Practice

Note/s: Excluded MATH1011, MATH1032, MATH1042, MATH1141, ECON2200, ECON2201, ECON2202, ECON1202, ECON2290, ECON2291.. Complex numbers, vectors and vector geometry, linear equations, matrices and matrix algebra, determinants. Functions, limits, continuity and differentiability, integration, polar coordinates, logarithms and exponentials, hyperbolic functions, functions of several variables. Introduction to computing and the Maple symbolic algebra package.

## MATH1141

**Higher Mathematics 1A** 

Staff Contact: School of Mathematics First Year Office CP15 S1 HPW6

*Prerequisites:* HSC mark range required: 2 and 3 unit Mathematics (145-150) or 3 and 4 unit Mathematics (186-200) (these ranges may vary from year to year.) **Note/s:** Excluded MATH1011, MATH1032, MATH1042, MATH1131, ECON2200, ECON2201, ECON2202, ECON1202, ECON2290, ECON2291.

As for MATH1131 but in greater depth.

## MATH1231

Mathematics 1B

Staff Contact: School of Mathematics First Year Office CP15 S2 HPW6 or Summer Session HPW9 Prerequisite: MATH1131 or MATH1141 Note/s: Excluded MATH1021, MATH1032, MATH1042, MATH1241, ECON2200, ECON2201, ECON2202, ECON1202, ECON2290, ECON2291.

Vector spaces, linear transformations, eigenvalues and eigenvectors. Probability. Integration techniques, solution of ordinary differential equations, sequences, series, applications of integration.

## **MATH1241**

## **Higher Mathematics 1B**

Staff Contact: School of Mathematics First Year Officee CP15 S2 HPW6

Prerequisite: MATH1131 or MATH1141, each with a mark of at least 70

Note/s: Excluded MATH1021, MATH1032, MATH1042, MATH1231, ECON2200, ECON2201, ECON2202, ECON1202, ECON2290, ECON2291.

As for MATH1231 but in greater depth.

## **MATH2009**

**Engineering Mathematics 2** 

Staff Contact: School of Mathematics Office CP20 HPW4

Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241

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.

## MATH2019

## **Engineering Mathematics 2CE**

Staff Contact: School Office CP15 F HPW3 Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241 Notes: Excluded MATH2009.. Partial differentiation and applications, vector algebra, double integrals, ordinary differential equations, introduction to vector field theory, extrema of functions of 2 variables, matrices and their applications, Laplace transforms, Fourier series, partial differential equations and their solution for selected physical problems.

### MATH2021 Mathematics 2

Staff Contact: School of Mathematics Office CP15 F HPW2 Prerequisite: MATH1021(CR) or MATH1032 or MATH1231 or MATH1042 or MATH1241 Note/s: Taught by the Keller plan self-paced learning method

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 of Mathematics Office CP7.5 S2 HPW2.5 Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241

Note/s: Excluded MATH2110, MATH2011.

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 of Mathematics Office CP7.5 S1 or S2 HPW2.5 Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241

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, first-order systems, singularities, boundary-value problems, eigenfunctions, Fourier series. Bessel's equation and Legendre's equation. Partial differential equations: characteristics, classification, wave equation, heat equation, Laplace's equation, separation of variables methods, applications of Bessel functions and Legendre polynomials.

## **MATH2819**

Statistics SA Staff Contact: School of Mathematics Office CP10 F HPW2 Prerequisite: MATH1021 or MATH1032 or MATH1231 or MATH1042 or MATH1241

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.

### MATH2869 Applied Statistics SC

Staff Contact: School of Mathematics Office CP5 S1 HPW2 Prerequisite: MATH1032 or MATH1231 or MATH1042 or MATH1241

Graphical data analysis, review of probability, random variables and their properties. The normal and binomial distributions, the central limit theorem, applications to quality control. Functions of random variables and their simulation using computers. One and two sample inference methods. Experimental designs for comparing two groups. Simple and multiple linear regression. Relevant applications from fields of engineering will be investigated in computer workshops.

## **MATH3021**

**Mathematics 3** 

Staff Contact: School of Mathematics Office CP15 F HPW2 Prerequisite: MATH2021

Note/s: Excluded any other Level III subject in Pure Mathematics or Applied Mathematics except for MATH3261. Taught by the Keller plan self-paced learning method.

Vector calculus; special functions; convolution theorem and applications; complex variable theory; Fourier integrals; Laplace transforms with application to ordinary and partial differential equations.

## MATH3030

## Mathematics 3, Part 1 Staff Contact: School of Mathematics Office CP7.5 S2 HPW2 Prerequisite: MATH2021 Note/s: Excluded MATH3021.

This subject is the first half of MATH3021. No mark will be returned for this subject until MATH3040 is also completed. All students will receive a grade of EC (enrolment continuing) for this subject, which will eventually be replaced by a mark when MATH3040 is completed.

## **MATH3040**

Mathematics 3, Part 2 Staff Contact: School of Mathematics Office CP7.5 S1HPW2 Prerequisite: MATH3030 Note/s: Excluded MATH3021.

This subject is the second half of MATH3021. The student must have been enrolled in MATH3030 previously and have a grade of EC in that subject. On completion of MATH3040 a grade will be returned for both MATH3030 and MATH3040.

## MECH0130

## Engineering Drawing and Solid Modelling

Staff Contact: Dr RA Platfoot CP10 SS L1 T3

**Note/s:** This is a servicing subject taught within courses offered by other schools and faculties.

Communication of form and layout of real world objects, solid modelling of objects. Engineering drawing layouts, orthogonal projections, dimensioning, tolerancing and standard drawing symbols, principles of detail design drawings and assembly drawings. Use of computer graphics and production of drawings.

## MECH0440

Engineering Statics Staff Contact: Dr CV Madhusudana CP7.5 SS L2 T1 Prerequisites: As for MECH1300 Engineering Mechanics 1 Note/s: Excluded MECH0330, MECH0360, MECH1300.

Composition and resolution of forces, laws of equilibrium. Friction. Statics of rigid bars, pin-jointed frames and beams. Simple states of stress. Statics of fluids.

## MECH1110

Graphical Analysis and Communication Staff Contact: Mr AJ Barratt CP7.5 S2 L1 T2 Note/s: Excluded MECH0130.

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: A/Prof RAJ Ford

CP10 S1 or S2 L2 T2

*Prerequisite:* HSC mark range required Either 2 unit Science (Physics) 53-100, or 3 unit Science 90-150, or 4 unit Science multistrand 1-50 or 2 unit Industrial Arts (Engineering Science) 53-100, or 3 unit Industrial Arts (Engineering Science) 1-50

Corequisite: MATH1032 or MATH1131 or MATH1042 or MATH1141

**Note/s:** Excluded MECH0330. Students can make up for the lack of the prerequisite by work taken in Physics in Session 1 of Year 1 and enrol in the subject in Session 2.

Vectors, resultants, equilibrium. Systems of co-planar multiforce members. Mass centre, centroids, distributed forces. Friction. Applications to cables, screw threads, clutches etc. Plane particle kinematics: rectilinear, curvilinear and relative motion. Plane particle kinetics: equations of motion, work, energy, power, impulse, momentum, impact.

## MECH2300

Engineering Mechanics 2A Staff Contact: A/Prof KP Byrne CP7.5 S1 or S2 L2 T1 Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, MECH1300 or MECH0360 Note/s: Excluded MECH0430.

Kinetics of systems of particles; 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 and momentum. Virtual work for static and dynamic systems. Engineering applications.

## MECH2310

Engineering Mechanics 2B Staff Contact: Prof KP Byrne CP5 S1 or S2 HPW2 Prerequisite: MECH2300

Differential equations of motion. Transverse vibrations of beams. Whirling of shafts. Single degree-of-freedom systems: free, forced, undamped and damped vibrations. Transmissibility.

## MECH2600

Fluid Mechanics 1 Staff Contact: Prof G.L. Morrison CP10 F L1 T1 Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, PHYS1919

Fluid properties. Fluids in static equilibrium. Bouyancy. Pressures in accelerating fluid systems. Steady flow energy equations. Flow measurement. Momentum equation. Dimensional analysis and similarity. Incompressible laminar and turbulent flow in pipes; friction factor. Laminar flow between parallel plates and in ducts. Elementary boundary layer flow; skin friction and drag. Pumps and turbines. Pump and pipe-line system characteristics.

## **MECH2700**

Thermodynamics 1 Staff Contact: A/Prof E Leonardi CP10 F L1 T1 Prerequisites: MATH1032 or MATH1231 or MATH1042 or MATH1241, PHYS1919

Basic concepts and definitions: systems, property, state, path, process. Work and heat. Properties of pure substances, tables of properties, equations of state. First Law of thermodynamics. Analysis of closed and open systems. Second law of thermodynamics: definitions, Carnot cycle, Clausius inequality, entropy, irreversibility, isentropic efficiencies. Air-standard cycles. Vapour cycles.

## MECH9325

Fundamentals of Noise Staff Contact: Dr JM Challen CP12 SS HPW3 Note/s: Excluded MECH4321.

Development of the acoustic plane wave equation, introduction of concepts of acoustic impedance, characteristic impedance, acoustic energy density, acoustic intensity and acoustic power. Measurement of sound pressure. Decibel scales. Standing waves. The effect of noise on people. Wave propagation in porous media. Transmission phenomena including transmission of plane waves between different media, through walls and along pipes. The analysis of expansion chamber mufflers and pipe side-branches. Basic energy approach to room acoustics.

## **MECH9326**

Advanced Noise Staff Contact: Dr JM Challen CP12 SS HPW3 Prerequisite: MECH4321 or MECH9325 Note/s: Excluded MECH4322.

The Helmholtz resonator. Transmission line formulae for one dimensional plane wave calculations. 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 CP12 SS HPW3 Note/s: Excluded MECH4400.

Theories of fracture; failure modes. Ductile, brittle fracture. Mechanics of crack propagation, arrest. Measurement of static fracture properties. Fatigue crack initiation, propagation. Engineering aspects of fatigue.

## MEED9102

## Educational Process in Small Groups Staff Contact: Mr A Hodgkinson

CP10 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: Prof A Rotem CP10 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 CP10 S1 HPW2

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.

## **MICR2011**

Microbiology 1 Staff Contact: Dr P March CP15 S2 HPW6 Prerequisites: BIOS1101, BIOS1201, MICR2201 Corequisites: BIOC2201 and BIOS2021

This subject is for students majoring in microbiology and who wish to enlarge their knowledge and skills in microbiology beyond those obtained in Introductory Microbiology or equivalent subjects at other institutions.

The biology, classification and function of bacteria. Comparative aspects of microbial growth. Bacterial nutrition and biosynthetic pathways. Microbial survival and global responses to environmental stimuli. Theory and practice of sterilization. Action of antimicrobial agents. Introduction to microbial ecology, medical and industrial microbiology.

### MICR2201 Introductory Microbiology Staff Contact: Dr I Couperwhite CP15 S1 HPW6

This introduction to microbiology is offered as a single 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.

## **MICR3041**

Immunology I Staff Contact: Dr A Collins CP15 S1 HPW6 Prereauisite: BIOC2201, Highly recommended: ANAT2211

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, antigenantibody reactions, the major histocompatibility complex, aspects of immunology in disease.

## **MICR3051**

Immunology 2 Staff Contact: Dr A Collins CP15 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: Prof S Kjelleberg CP15 S2 HPW6 Prerequisite: MICR2201 Highly recommended: MICR2011,BIOC2201, BIOS2021

The course consists of five major themes in basic and applied environmental microbiology: microbial ecology, genes and the environment, water and water pollution, biofilms, and environmental biotechnology. The main concepts include biodiversity, structures of microbial communities and microbial interactions. Specific topics in microbial ecology include biodiversity, microbial interactions and communities, biogeochemical cycling, adaption to nutrient limitation, gene transfer and evolution and phylogeny. Specific topics in applied and environmental microbiology include waste water treatment and water quality, biofouling, biological control, bioremediation, and the use of smart molecules produced by microorganisms.

## MICR2218

#### Microbiology Staff Contact: Dr I Couperwhite

Solely for students enrolled in the Food Technology courses in the Faculty of Applied Science.

## MNGT0373 Organisational Design CP10

Prereauisite: MNGT0270 or consent of instructor

Extends the structural analysis of organisations introduced in MNGT0270 or equivalent. Topics include power, informal organisation, 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.

## PHPH5461

## Principles of Pharmacology Staff Contact: Dr M Frver

This subject introduces the principles of pharmacology and also covers the systematic pharmacology of selected drug groups. It is designed for students with a background in biotechnology but with little or no knowledge of pharmacology. The subject covers topics such as dose response relationships, drug absorption, metabolism and elimination, autonomic pharmacology, autacoids, pharmacokinetics and toxicology.

## PHPH5471

Advanced Pharmacology Staff Contact: Dr M Fryer CP24

Prerequisites: PHPH3152, PHPH5461

This subject is an advanced coverage of pharmacological topics including receptor binding, pharmacokinetics, drug assays, drug development, toxicology, autacoids and ion channels. The lecture material is supplemented by computerised analysis of data derived from experiments on receptor binding, dose response relationships and pharmacokinetics. Considerable emphasis is placed on the many aspects of drug development.

## PHPH5481

## Advanced Pharmacology Project Major

Staff Contact: Dr M Fryer CP64

A laboratory or industry based project in the area of drug development.

## PHPH5491

Advanced Pharmacology Project Minor Staff Contact: Dr M Fryer

CP32

A small laboratory or industry based project or an extensive literature review or extensive data analysis in the area of drug development.

## **PROF0003**

## Qualitative Research Procedures Staff Contact: To be advised CP15 SS HPW2

This subject introduces students to the nature of, and methods for conducting naturalistic inquiry. Topics include the naturalistic research approach, naturalistic research questions, the naturalistic research process, qualitative data collection and analysis methods, qualitative program evaluation.

## **Physics Level I Subjects**

Notes: Where mathematics subjects are specified as prerequisites or as corequisites, the higher levels of such subjects are acceptable and preferable. The total value of the combination of PHYS1022 and PHYS1002 is 45 Credit Points.

## PHYS1002

Physics 1 Staff Contact: First Year Director CP30 F HPW6

*Prerequisites:* HSC Exam Score Range Required: 2 unit Mathematics (90-100), or 2 and 3 unit Mathematics (100-150), or 3 and 4 unit Mathematics (100-200) or (for PHYS1002 only) MATH1011, and 2 unit Science (Physics) 57-100, or 2 unit Science (Chemistry) 60-100, or 3 unit Science 90-150, or 4 unit Science 1-50 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 or MATH1131 and MATH1231.

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.

## **Mid-year Start**

Students who fail Session 1 of PHYS1002 are strongly advised to discontinue the subject and enrol in Session 2 in PHYS1011 Physics I (FT1). This subject covers the Session 1 material of PHYS1002 during Session 2. Then PHYS1021 covers the rest of the syllabus over the Summer Session.

Note: The Session 2 syllabus of PHYS1002 is not repeated in Session 1 of the next year.

## PHYS1022

Physics 1 For Health and Life Scientists Staff Contact: First Year Director CP30 F HPW6 Coreauisites: MATH1021 or MATH1032 or MATH1131.

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, ions and ionic conduction, magnetism and electromagnetic induction, alternating current, atomic nature of matter, X-rays, the nucleus and radio-activity, geometrical optics, optical instruments, wave optics, microscopes and their uses.

#### PHYS1936 Physics 1 (Textile Management)

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 CP15 S1 HPW4 Prerequisites: PHYS1002, MATH1032 or MATH1231. Corequisite: MATH2011 or MATH2110 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 CP15 S2 HPW4 Prerequisites: PHYS1002, MATH1032 or MATH1231 Corequisites: MATH2011 or MATH2110 Note/s: Excluded PHYS2999.

Electric field strength and potential, Gauss' law, Poisson's and Laplace's equations, capacitance, dielectrics and polarisation, magnetism, electro-magnetic 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

 CP15 F HPW2

 Prerequisites: PHYS1002, MATH1032 or MATH1231

 Note/s: Excluded PHYS2989, PHYS2949.

Wave-particle duality. Operators, postulates of quantum mechanics. Applications: steps, barriers and tunnelling. H atom. Orbital, spin angular momentum, magnetic moment. Spin orbit interaction. Molecules, LCAO, rotation and vibration. Introduction to statistical mechanics. The nucleus: properties, forces, models, fission and fusion. Special theory of relativity, simultaneity, time dilation, length contraction, momentum and energy.

## PHYS2031

Laboratory Staff Contact: Executive Assistant CP15 F HPW3 Prerequisites: PHYS1002, MATH1032 or MATH1231 Note/s: Excluded PHYS2920.

Experimental investigations in a range of areas: x-ray 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.

### Physics Level III Subjects

Note: See notes for Physics Level II subjects.

#### PHYS3021

Statistical Mechanics and Solid State Physics Staff Contact: Executive Assistant

CP15 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, free-electron models of metals, band theory, point defects, dislocations.

#### PHYS3060

Advanced Optics Staff Contact: Executive Assistant CP7.5 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 CP7.5 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 super-conductivity. Fourier optics, holography.

#### PHYS3120

**Experimental Physics B2** 

Staff Contact: Executive Assistant CP7.5 S2 HPW4 Prerequisite: PHYS2031

As for PHYS3110 Experimental Physics B1.

## PHYS3410

Biophysics Staff Contact: Executive Assistant CP7.5 S2 HPW2 Prerequisites: PHYS2011, PHYS2410

Physics of self-assembling systems, cellular ultrastructure. Thermodynamics of irreversible processes, application to life processes. Thermodynamical description of ecological associations. Structure of proteins and other macromolecules. Physics of nerve and muscle.

### PHYS3710

Lasers and Applications Staff Contact: Executive Assistant CP7.5 S1 HPW2

Note/s: Offered in odd-numbered 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.

### PHYS2920

Electronics (Applied Science) Staff Contact: Executive Assistant CP7.5 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.

#### SCTS3106

Technology, Sustainable Development and the Third World

Staff Contact: John Merson CP15 S1 HPW3 Prerequisite: As for SCTS2106 Note/s: Excluded 62.082, 62.282, 62.206U, SCTS3001.

This subject is about sustainable development along with the technological and social changes that are involved in achieving it, both at a national and global level. It is divided into three parts: (1) the historical causes of the present global environmental and economic crisis; (2) possible solutions to problems of food production, environmental degradation, industrialisation, energy use, and population growth; (3) ideas for a New World Economic Order and the economic and technological changes required to bridge the ever increasing gap between rich and poor nations. Assessment: Essay, tutorials.

### SCTS3116

The Political Economy of Energy and Sustainable Development Staff Contact: Gavan McDonell CP15 S2 HPW3 Prerequisite: As for SCTS2106 Note/s: Subject not offered in 1997. Excluded 62.222U, SCTS3011.

Assessment: Essays, tests, tutorials.

212 APPLIED SCIENCE

# **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 the University, 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.

| Title                             | Abbreviation | Calendar/Handbook    |
|-----------------------------------|--------------|----------------------|
| Higher Degrees                    |              |                      |
| Doctor of Science                 | DSc          | Calendar             |
| Doctor of Letters                 | DLitt        | Calendar             |
| Doctor of Laws                    | LLD          | Calendar             |
| Doctor of Education               | EdD          | Professional Studies |
| Doctor of Juridicial Science      | SJD          | Law                  |
| Doctor of Medicine                | MD           | Medicine             |
| Doctor of Philosophy              | PhD          | Calendar             |
|                                   |              | and all handbooks    |
| Master of Applied Science         | MAppSc       | Applied Science      |
| Master of Architecture            | MArch        | Built Environment    |
| Master of Archives Administration | MArchivAdmin | Professional Studies |
| Master of Art                     | MArt         | College of Fine Arts |
| Master of Art Administration      | MArtAdmin    | College of Fine Arts |
| Master of Art Education           | MArtEd       | College of Fine Arts |
| Master of Art Education(Honours)  | MArtEd(Hons) | College of Fine Arts |

| Title                                    | Abbreviation     | Calendar/Handbook                              |
|--|------------------|--|
| Master of Arts                           | MA               | Arts and Social Sciences<br>University College |
| Master of Arts (Honours)                 | MA(Hons)         | Arts and Social Sciences                       |
| Master of Art Theory                     | MArtTh           | College of Fine Arts                           |
| Master of Biomedical Engineering         | MBiomedE         | Engineering                                    |
| Master of Building                       | MBuild           | Built Environment                              |
| Master of the Built Environment          | MBEnv            | Built Environment                              |
| Master of the Built Environment          |                  |  |
| (Building Conservation)                  | MBEnv            | Built Environment                              |
| Master of Business Administration        | MBA              | AGSM   |
| Master of Business Administration        |                  |  |
| (Executive)                              | MBA(Exec)        | AGSM   |
| Master of Business and Technology        | MBT              | Engineering                                    |
| Master of Chemistry                      | MChem            | Science*                                       |
| Master of Clinical Education             | MClinEd          | Medicine                                       |
| Master of Commerce (Honours)             | MCom(Hons)       | Commerce and Economics                         |
| Master of Commerce                       | MCom             | Commerce and Economics                         |
| Master of Community Health               | MCH              | Medicine                                       |
| Master of Community Paediatrics          | MCommPaed        | Medicine                                       |
| Master of Computational Science          | MComputationalSc | Science  |
| Master of Computer Science               | MCompSc          | Engineering                                    |
| Master of Construction Management        | MConstMat        | Built Environment                              |
| Master of Couple and Family Therapy      | MCET             | Professional Studies                           |
| Master of Defence Studies                | MDefStud         | University College                             |
| Master of Design (Honours)               | MDec(Hone)       | College of Eine Arts                           |
| Master of Education                      | MEd              | Professional Studies                           |
| Master of Education in Creative Arts     | MEdCA            | Professional Studies                           |
| Master of Education in Teaching          | MEdCA            | Professional Studies                           |
| Master of Educational Administration     | MEdAdmin         | Professional Studies                           |
| Master of Engineering                    | MEGAGINI         | Applied Science                                |
| Master of Engineering                    |                  | Engineering                                    |
|  |                  | Liniversity College                            |
| Master of Engineering without            |                  | eniversity conege                              |
| supervision                              | MF               | Applied Science                                |
| caperneren                               |                  | Engineering                                    |
| Master of Engineering Science            | MEnaSc           | Engineering                                    |
| indeter et Eligiteeting eelettee         | mengee           | Applied Science                                |
|  |                  | University College                             |
| Master of Environmental                  |                  | entrolony eenege                               |
| Engineering Science                      | MEnvEndSc        | Engineering                                    |
| Master of Environmental Studies          | MEnvStudies      | Applied Science                                |
| Master of Equity & Social Administration | MEnVoluaios      | Professional Studies                           |
| Master of Eine Arts                      | MEQCOUNTIN       | College of Fine Arts                           |
| Master of Health Administration          | МНА              | Professional Studies                           |
| Master of Health Personnel Education     | MHPEd            | Medicine                                       |
| Master of Health Planning                | MHP              | Professional Studies                           |
| Master of Higher Education               | MHEd             | Professional Studies                           |
| Master of Industrial Design              | MID              | Ruit Environment                               |
| Master of Information Management         | NALKA            | Built Environment<br>Professional Studios      |
| Master of Information Science            | MinfSc           | Engineering                                    |
| Master of International Social           | Williec          | Engineering                                    |
| Development                              | MintSocDov       | Professional Studios                           |
| Master of Medicine                       | MMod             | Modicino                                       |
| Master of Landscape Architecture         | MI Arch          | Ruit Environment                               |
| Master of Landscape Alchitecture         | MLD              | Built Environment                              |
| Master of Lawa                           |                  | Low  |
| Master of Librarianship                  |                  | Law<br>Profossional Studios                    |
| Viasier of Librarianship                 |                  | Fibiosofiu College                             |
| Viaster of Mathematics                   | NIVIGIEC         | Chiversity College                             |
| viaster of Mathematics                   | wiviath          | Sulence"                                       |
| viasier of Medicine                      |                  |  |
| viaster of Mining Management             | MMINMgmt         | Applied Science                                |
| VIASIER OF MUSIC                         |                  | Arts and Social Sciences                       |
| viaster of Music (Honours)               | MMUS(HONS)       | Arts and Social Sciences                       |
|  |                  |  |

| Title  | Abbreviation   | Calendar/Handbook   |
|--|--|---|
| Master of Music Education (Honours)<br>Master of Optometry<br>Master of Policy Studies<br>Master of Project Management<br>Master of Public Health<br>Master of Psychological Medicine<br>Master of Psychology (Applied)<br>Master of Psychology (Clinical)                                       | MMusEd(Hons)<br>MOptom<br>MPS<br>MProjMgt<br>MPH<br>MPSychol<br>MPsychol   | Arts and Social Sciences<br>Science*<br>Arts and Social Sciences<br>Built Environment<br>Medicine<br>Professional Studies<br>Medicine<br>Science†<br>Sciencet |
| Master of Real Estate  | MRE  | Built Environment   |
| Master of Real Property<br>Master of Safety Science<br>Master of Science   | MRProp<br>MSafetySc<br>MSc   | Built Environment<br>Applied Science<br>Applied Science<br>Built Environment<br>Engineering<br>Medicine<br>Science*†<br>University College                    |
| supervision  | MSc  | Applied Science<br>Built Environment<br>Engineering   |
| Master of Science<br>(Industrial Design)<br>Master of Social Work<br>Master of Sports Science<br>Master of Sports Medicine<br>Master of Statistics<br>Master of Statistics<br>Master of Statistics<br>Master of Taxation<br>Master of Town Planning<br>Master of Urban Development and<br>Design | MSc(IndDes)<br>MSW<br>MSpSc<br>MSpMed<br>MStats<br>MS<br>MTax<br>MTP<br>MUDD   | Built Environment<br>Professional Studies<br>Professional Studies<br>Medicine<br>Science*<br>Medicine<br>ATAX<br>Built Environment<br>Built Environment       |
| Graduate Diplomas  |  |   |
| Graduate Diploma   | GradDip  | AGSM<br>Applied Science<br>Architecture<br>Arts and Social Sciences<br>Commerce and Economics<br>Engineering<br>Medicine<br>Professional Studies<br>Science*t |
| Advanced Taxation<br>Arts<br>Couple and Family Therapy<br>Clinical Education<br>Community Paediatrics<br>Equity and Social Administration<br>Higher Education<br>Health Personnel Education<br>Information Management -  | GradDipAdvTax<br>GradDipArts<br>GradDipC/F Therapy<br>GradDipClinEd<br>GradDipCommPaed<br>GradDipEq&SocAdmin<br>GradDipHEd<br>GradDipHEd | Board of Studies in Taxation<br>Arts and Social Sciences<br>Professional Studies<br>Medicine<br>Professional Studies<br>Professional Studies<br>Medicine      |
| Archives/Records<br>Information Management -   | GradDiplM-Archiv/Rec   | Professional Studies  |
| Librarianship<br>Industrial Management<br>International Social Development<br>Music<br>Paediatrics<br>Pharmaceutical Sciences  | GradDipIM-Lib<br>GradDipIndMgt<br>GradDipIntSocDev<br>GradDipMus<br>GradDipPaed<br>GradDipPharmSc  | Professional Studies<br>Engineering<br>Professional Studies<br>Arts and Social Sciences<br>Medicine<br>Medicine   |

| Title  | Abbreviation  | Calendar/Handbook  |
|--|---|--|
| Sports Medicine<br>Taxation Studies<br>Education<br>Food and Drug Analysis | GradDipSpMed<br>GradDipTaxStud<br>DipEd<br>DipFDA                 | Medicine<br>Board of Studies in Taxation<br>Professional Studies<br>Science*                       |
| Graduate Certificates  |   |  |
| Arts<br>Commerce<br>Health Administration                                  | GradCertArts<br>GradCertCom<br>GradCertHealthAdmin<br>GradCertHEd | Arts and Social Sciences<br>Commerce and Economics<br>Professional Studies<br>Professional Studies |

GradCertMus

GradCertPharmSc

Arts and Social Sciences

Medicine

\*Faculty of Science.

Pharmaceutical Sciences

†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

Music

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 co-supervisor 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 co-supervisor 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.

(ii) 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 re-examination.

(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 in the further work recommended under (2)(c) above is not to the satisfaction of the Committee, the Committee may permit the candidate to submit the thesis for re-examination as determined by the Committee within a period determined by it but not exceeding eighteen months.

(4) After consideration of the examiners' reports and the results of any further examination of the thesis, the Committee may require the candidate to submit to written or oral examination before recommending whether or not the candidate 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 threefull-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.

\*'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.

# 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.

(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 120 credit points. The number of credit points 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.

### 36 to 48 Project Report

4. (1) A candidate who undertakes a36 to 48 credit points 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 36 to 48 Credit Point 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 in 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 lodge 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 allocate 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

### 48 credit point Project Report

4. (1) The program of advanced study may include a 48 credit point 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 48 credit point 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.

## Master of Technology Management MTM

1. The degree of Master of Technology Management by formal course work 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 considered acceptable to the Course Committee<sup>1</sup>. This is normally either:

(a) a four year degree, or,

(b) a three year degree plus *either* another qualification at an acceptable level, *or*, other academic or professional attainments (including relevant work experience).

(2) An applicant who submits evidence of such other academic and professional qualifications as may be approved by the Committee may be permitted to enrol in the degree.

If the Committee is not satisfied with the qualifications submitted by an applicant the Committee may require that the applicant undergo such assessment, or carry out such work, as the Committee may prescribe before permitting enrolment.

### **Enrolment and Progression**

3. An application to enrol as a candidate for a 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.

A candidate for the degree shall be required to undertake such formal subjects and pass such assessments as prescribed.

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.

No candidate shall be awarded the degree until the lapse of at least two academic sessions from the date of enrolment in the case of full time enrolment or four academic sessions in the case of part time enrolment. The maximum period of enrolment shall be 4 academic sessions for a full time candidate and 8 academic sessions for a part time candidate. In special cases variations to 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.

# Scholarships

The scholarships listed below are available to students whose courses are listed in this book. Each faculty handbook contains in its scholarships section the scholarships available for study in that faculty. Travel scholarships are shown separately. Applicants should note that the scholarships and their conditions are subject to review and the closing dates for awards may vary from year to year.

Scholarship information is regularly included in the University publication 'Uniken/Focus'.

Students investigating study opportunities overseas should also consult Study Abroad which is published by UNESCO and is available in the University library. The British Council (02 9326 2365) may be of assistance for information about study in Britain. The Australian-American Education Foundation (06 247 9331) can provide information about study in America. Information may also be obtained from the embassy or consulate of the country in which the study is proposed and from the proposed overseas institution. Details of overseas awards and exchanges administered by the Department of Employment, Education, Training and Youth Affairs (DEETYA) can be obtained from the Awards and Exchanges Section, DEETYA, PO Box 826, Woden, ACT 2606.

### KEY

- L Students with Australian Citizenship or Permanent Resident status can apply.
- I International students can apply.

# Postgraduate scholarships for research or coursework are identified with the following codes:

- **R** Available for study by research (normally Masters by Research or PhD).
- C Available for study by coursework (normally Masters by Coursework or Graduate Diploma).

The scholarship information is normally provided in the following format:

- Amount
- Duration
- Conditions

Unless otherwise stated, application forms are available from the Scholarships Unit, c\- the Student Centre (Lower Ground Floor, Chancellery). Applications normally become available four to six weeks before the closing date.

# **Undergraduate Scholarships**

Following are details of scholarships available to undergraduate students at UNSW.

The scholarships are listed according to the year of study for which the scholarship is available (ie scholarships for first year students; scholarships for second or later year students; scholarships for Honours year students) or whether they are available to undertake travel, and then also by Faculty and course (eg scholarships in Science or Engineering). If a scholarship is available to all students it will be listed in the General Scholarships section. For further information contact:

The Scholarships Unit The University of New South Wales Sydney 2052 Australia Tel (02) 9385 3100/3101/1462 Fax (02) 9662 1049 Email: R.Plain@unsw.edu.au

# Scholarships for students entering the first year of an undergraduate course

# General

## The Alumni Association Scholarships (I,L)

- Up to \$1,500 pa
- 1 year with the possibility of renewal

The scholarships are available to students enrolled in any year of a full-time undergraduate course. Candidates must be the children or grandchildren of alumni of the University of New South Wales. Applications close mid-January.

## The Australian Development Co-operation Scholarship (ADCOS) (I)

- Tuition fees. Some students may be eligible for airfares and a stipend
- · Determined by normal course duration

This award is for international students from selected countries only. Information and application forms should be obtained from the Australian Education Centre or Diplomatic Post in the home country. The award conditions and entitlements vary depending on the home country. The closing date is normally early in the year before the year of study.

## The Australian Vietnam Veterans Trust Education Assistance Scheme (L)

• \$3,500 pa for the duration of the course

Applicants must be a child of a Vietnam veteran and under the age of 25 at the time of application. The award is subject to the same income test as AUSTUDY. Applicants can be undertaking any year of a Bachelors course. Applications and further information are available from the Australian Vietnam War Veterans Trust National Office, PO Box K978, Haymarket NSW 2000 (02 9281 7077). Applications close 31 October.

# The Ben Lexcen Sports Scholarships (I,L)

- \$2,000 pa
- 1 year with possibility of renewal

The scholarships are 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 the Manager, Sports Association, UNSW, Sydney 2052 Australia. Tel (02) 9385 6022, Fax (02) 9385 6180.

## The UNSW Co-Op Program (L)

- \$10,400 pa and between 9 and 20 months industry training
- The duration of the course subject to satisfactory progress

The scholarships are offered by industry groups through the University in the three faculties of Applied Science, Commerce and Economics and Engineering. Scholars are selected by interview with emphasis placed on achievements in community and extra-curricular activities as well as communication and leadership skills.

A minimum TER of around 90 is expected. The Co-Op Application Form is available from school Careers Advisers or the Co-op Office on (02) 9385 5116. Applications close September 30 with interviews held at the end of November and beginning of December.

## The Girls Realm Guild Scholarships (L)

- Up to \$1,500 pa
- 1 year with the prospect of renewal subject to satisfactory progress and continued demonstration of need

The scholarships are available to female students under 35 years of age who are enrolling in any year of a full-time undergraduate course. Selection is based on academic merit and financial need. Applications close 25 March.

## The John Niland Scholarships (L)

- \$5,000
- 1 year

The scholarship provides assistance to enhance the opportunity of students from country high schools in Australia to enrol in an undergraduate program of study at UNSW. Applicants will be students who complete the HSC (or its counterpart matriculation requirement) in the top five percent of their state-wide cohort, having been enrolled at a country high school in Australia. Selection will be based on academic merit, potential to contribute to the wider life of the University and consideration of social and/or economic circumstances which might otherwise hinder successful transition to UNSW. Applications close 30 October.

## The National Health and Medical Research Council (NH&MRC) Aboriginal Health Research Scholarships (L)

- \$22,250
- Up to 3 years

Applicants may be undertaking an undergraduate degree in order to pursue research relevant to Aboriginal health. Applications close mid-July.

## The Ngunnagan Club Scholarship (L)

- Up to \$2,000
- 1 year

The scholarship is available to students enrolled at an Australian country high school who complete the HSC (or its counterpart matriculation requirement) in the top five per cent of their state cohort. Applicants should complete an official application form by 31 October in the year prior to their intended enrolment at UNSW. Final performance in the HSC (or its counterpart matriculation) examination should be reported to the Scholarships Unit once known.

## The W.S. and L.B. Robinson Scholarship (L)

- Up to \$6,500 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

Applicants must have completed their schooling in Broken Hill or have parents who reside in Broken Hill. Applicants should be undertaking a course related to the mining industry, for example courses in Mining Engineering, Geology, Electrical and Mechanical Engineering, Metallurgical Process Engineering, Chemical Engineering or Science. A letter of application should be sent to Pasminco Mining, PO Box 460, Broken Hill, NSW 2880. Applications close 30 September each year.

# **Faculty of Applied Science**

Students planning to undertake year one of a bachelors degree in any school of the Faculty of Applied Science can apply for the Malcolm Chaikin Foundation Scholarship.

## The Malcolm Chaikin Foundation Scholarship (L)

- Up to \$9,000 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

The scholarship is available to students entering the first year of a Bachelor of Science or Engineering in the Faculty of Applied Science. Applications close early January.

School of Materials Science and Engineering

# **Ceramic Engineering**

## The Australasian Ceramic Society Scholarship (L)

- Up to \$400 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

Applicants must be eligible for admission to year 1 of the full-time degree course in ceramic engineering. Applications normally close at the end of January.

## The Clay Brick Association Scholarship (L)

- Up to \$2,500 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

Applicants must be eligible for admission to year 1 of the full-time degree course in ceramic engineering.

A new scholarship is only offered when the current scholarship recipient completes his/her course. It is expected that a new award will be available in 1997. Applications normally close at the end of January.

## The CSR Building Scholarship (L)

- Up to \$1,000 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

Applicants must be eligible for admission to year 1 of the full-time degree course in ceramic engineering.

A new scholarship is only offered when the current scholarship recipient completes his/her course. It is expected that a new award will be available in 1999. Applications normally close at the end of January.

## The Monier PGH Scholarship (L)

- Up to \$1,000 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

Applicants must be eligible for admission to year 1 of the full-time degree course in ceramic engineering. Applications normally close at the end of January.

# The Thomson Family Scholarship (L)

- Up to \$1,000 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

Applicants must be eligible for admission to year 1 of the full-time degree course in ceramic engineering. Applications normally close at the end of January.

# Metallurgy

# The Sir Rupert Myers Scholarship (I,L)

- Up to \$2,500 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

The scholarship is available to students who are permanent residents of Australia or whose parents are permanent residents of Australia. Applicants must be eligible for admission to Year 1 of the full-time degree course in Metallurgy or Metallurgical Engineering. Applications normally close at the end of January.

# **School of Applied Bioscience**

Food Science and Technology

## The Coca-Cola South Pacific Export Corporation Scholarship (L)

- Up to \$1,800 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

Applicants must not be more than 22 years of age on 1 December of the year preceding the year in which the award commences. Applicants must be eligible for admission to year 1 of the full-time degree course in food science and technology. Applications normally close at the end of January.

# The George Weston Foods Scholarship (L)

- Up to \$1,500 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

Applicants must be eligible for admission to year 1 of the full-time degree course in Food Science and Technology. Applications normally close at the end of January.

# Scholarships for students in their second or later year of study

# General

# The Alumni Association Scholarships (I,L)

- Up to \$1,500 pa
- 1 year with the possibility of renewal

The scholarships are available to students enrolled in any year of a full-time undergraduate course. Candidates must be the children or grandchildren of alumni of the University of New South Wales. Applications close early January.

# The Australian Vietnam Veterans Trust Education Assistance Scheme (L)

\$3,500 pa for the duration of the course

Applicants must be a child of a Vietnam veteran and under the age of 25 at the time of application. The award is subject to the same income test as AUSTUDY. Applicants can be undertaking any year of a Bachelors course. Applications and further information are available from the Australian Vietnam War Veterans Trust National Office, PO Box K978, Haymarket NSW 2000 (tel 02 9281 7077). Applications close 31 October.

# The Ben Lexcen Sports Scholarships (I,L)

- \$2,000 pa
- 1 year with possibility of renewal

The scholarships are 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 the Manager, Sports Association, UNSW, Sydney 2052. Tel (02) 9385 6022, Fax (02) 9385 6180.

# The Girls Realm Guild Scholarship (L)

- Up to \$1,500 pa
- 1 year with the prospect of renewal subject to satisfactory progress and continued demonstration of need

The scholarships are available only to female students under 35 years of age who are enrolling in any year of a

full-time undergraduate course. Selection is based on academic merit and financial need. Applications close 25 March.

## The Minproc Engineering Limited Scholarship (L)

- \$6500 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

The scholarship is available to a student entering either Year 3 or 4 of the Bachelor of Engineering Science course with subject content in the fields of Engineering or Mineral Chemistry, or a Bachelor of Engineering with majors in the fields of Chemical, Metallurgical or Mechanical Engineering, or related courses. Applications close early March.

### The National Health and Medical Research Council (NH&MRC) Aboriginal Health Research Scholarships (L)

- \$22,250
- Up to 3 years

Applicants may be undertaking an undergraduate degree in order to pursue research relevant to Aboriginal health. Applications close mid July.

# The NSW Ministry for the Arts Scholarships (L, R, C)

• \$5,000/\$25,000 (depending on the award)

The NSW Government offers a number of scholarships and awards to writers, artists and scholars living in NSW. Further information is available from New South Wales Ministry for the Arts, GPO Box 5341, Sydney NSW 2000. Tel (02) 9228 3533, Fax (02) 9228 4722.

### The Pig Research and Development Corporation (PRDC) Undergraduate Encouragement Award (L)

\$600 lump sum

Applicants must be in the later stage of an undergraduate degree and interested in undertaking a research project related to the Australian pig industry. Applications close 3 times a year (ie 1 March, 1 July, 1 October).

## The Sam Cracknell Memorial Scholarships (I,L)

- Up to \$1,500 pa
- 1 year

Applicants should have already completed at least 2 years of a degree or diploma course and be enrolled in a full-time course during the year of application. Selection is based on academic merit, participation in sport both directly and administratively and financial need. Applications close 31 March.

### The Telstra Education Fellowships (L)

- \$7,500
- 1 year

Applicants must be in the final year of study in the disciplines of computer, electrical or electronic engineering or computer science. Applications normally close at the end of July.

## The W.S. and L.B. Robinson Scholarship (L)

- Up to \$6,500 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

Applicants must have completed their schooling in Broken Hill or have parents who reside in Broken Hill. Applicants should be undertaking a course related to the mining industry, for example courses in Mining Engineering, Geology, Electrical and Mechanical Engineering, Metallurgical Process Engineering, Chemical Engineering and Science. A letter of application should be sent to Pasminco Mining, PO Box 460, Broken Hill, NSW 2880. Applications close 30 September.

# Faculty of Applied Science

Students undertaking the final year of an undergraduate course in any school of the Faculty of Applied Science may be eligible to apply for the Spruson and Ferguson Scholarship for Innovation in Applied Science.

### The Spruson and Ferguson (Patent Attorneys) Scholarship for Innovation in Applied Science (L)

- The value may vary each year
- 1 year

The scholarship is available to students undertaking the final year of an undergraduate course in any school of the Faculty of Applied Science. Applicants are required to submit an application and a 200 word outline of their proposed research topic. Applications close early March.

# School of Fibre Science and Technology

Wool and Animal Science

# NSW Farmers Association E.L. O'Brien Scholarship (L)

- Up to \$2,000 pa
- 1 year

The NSW Farmers Association is offering a scholarship for a student entering Year 4 of the Wool and Pastoral Sciences course. Applicants must be a member, or child of a member of the Association. Applications close early March.Petroleum Engineering

# School of Materials Science and Engineering

## Metallurgy

# The Pasminco Scholarship (L)

- Up to \$1,000 pa
- 1 year

One scholarship is available for a student entering Year 4 of the Bachelor of Metallurgical Engineering. A letter of application should be sent direct to the School of Materials Science and Engineering. Applications close early March.

# **School of Mines**

# The BHP Minerals Scholarship in Mining Engineering (L)

- \$10,000 pa and payment of HECS
- Up to 3 years subject to satisfactory progress

The scholarship is available to students in the second year of the Mining Engineering degree at the University of New South Wales. Selection will be based on academic performance in the first year of the degree. Applications close 31 March.

## The Charles Warman Scholarship (L)

- \$4,000 pa
- 1 year renewable subject to satisfactory progress

The scholarship is available to students enrolling in Year 3 or 4 of the full-time degree course in Mineral Engineering (BE or BE/BSc). Applications close early March.

## The Dyno Wesfarmers Blasting Scholarship (L)

- Up to \$7,000 pa
- 2 years

The scholarship is available for Years 3 and 4 of the Mining Engineering course, subject to satisfactory progress. The scholarship is offered every second year and will be offered again in 1998.

## The Komatsu Scholarship (L)

- Up to \$2,000 pa in two equal instalments
- 1 year

The scholarship is available to the student with the best performance in Year 3 and entering Year 4 of the Mining Engineering course. The student is nominated by the School there is no application.

# The Mintech Scholarship (L)

- Up to \$1,000 pa
- 1 year

The scholarship is to be awarded to a full-time student in the final year of the Mining Engineering degree at the University of New South Wales.

The applicant's thesis topic must be in the fields of drill and blast technology. The scholarship will be awarded on the basis of academic merit and financial need. Applications close 31 March.

## The RGC Scholarship in Economic Geology (L)

- \$5,000
- 1 year

The scholarship is available to a student entering Stage 4 of the Applied Geology course or an Honours year in Geology in the Science course, undertaking a field project relevant to economic geology. Letters of application and requests for information should be directed to RGC, Gold Fields House, 1 Alfred St, Sydney NSW 2000. Applications close 31 January.

## Shell Coal Undergraduate Scholarship

- \$10,000 pa
- · up to 3 years subject to satisfactory progress

The scholarship is available to students in the second year of the Mining Engineering degree at the University of New South Wales. Selection will be based on academic performance in the first year of the degree. Applications close 31 March.

## The Voest Alpine Scholarship (I,L)

- Up to \$3,000 payable in two equal instalments
- 1 year

The scholarship is available to the student with the best performance in Year 2 and entering Year 3 of the Mining Engineering course. The student is nominated by the School – there is no application.

# **Centre for Petroleum Engineering**

## The Society of Petroleum Engineers Pty Ltd (L)

Up to \$2,500

Applicants must have completed the first two years of any accredited Engineering program. Applications and enquiries should be directed to the Society of Petroleum Engineers in the student's home state.

# **Honours Year Scholarships**

# General

## The Alumni Association Scholarships (I,L)

- Up to \$1,500 pa
- · 1 year with the possibility of renewal

The scholarships are available to students enrolled in any year of a full-time undergraduate course. Candidates must be the children or grandchildren of alumni of the university of new south wales. Applications close 13 January.

# The Apex Foundation for Research into Intellectual Disability Studentships (I,L)

• \$1,000 paid in a lump sum

The studentships are available to students preparing a thesis related to intellectual disability. Applications should be in the form of a letter which includes a curriculum-vitae and thesis plan and must be supported by a letter from the head of school/department. Applications should be sent to the honorary secretary, apex foundation studentships, PO Box 311, Mt Evelyn Vic 3796 by 31 May.

### The Australian and New Zealand Council for the Care of Animals in Research and Teaching (ANZCCART) Student Award (I,L)

• \$1,000 for attendance at the annual conference

Applicants can be Honours students from any discipline. The award provides assistance for a student to attend the annual conference. Applications are available from ANZCCART, PO Box 19 Glen Osmond, SA, 5064, (tel 08 303 7325). Applications close in July.

## The Australian Vietnam Veterans Trust Education Assistance Scheme (L)

• \$3,500 pa for the duration of the course

Applicants must be a child of a Vietnam veteran and under the age of 25 at the time of application. The award is subject to the same income test as AUSTUDY. Applicants can be undertaking any year of a Bachelors course. Applications and further information are available from the Australian Vietnam War Veterans Trust National Office, PO Box K978, Haymarket NSW 2000 (tel 02 9281 7077). Applications close 31 October.

## The Ben Lexcen Sports Scholarships (I,L)

- \$2,000 pa
- 1 year with possibility of renewal

The scholarships are 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 the Manager, Sports Association, UNSW, Sydney 2052. Tel (02) 9385 6022, Fax (02) 9385 6180.

# The Girls Realm Guild Scholarships (L)

- Up to \$1,500 pa
- 1 year with the prospect of renewal subject to satisfactory progress and continued demonstration of need

The scholarships are available only to female students under 35 years of age who are enrolling in any year of a full-time undergraduate course. Selection is based on academic merit and financial need. Applications close 25 March.

## The Grains Research and Development Corporation (GRDC) Undergraduate Honours Scholarship (I,L)

- \$6,000 (ie \$5,000 to the student and \$1,000 to the host School/Department.
- 1 year

Applicants must be undertaking a full-time Honours program. Study in an area of significance to the grains industry will be viewed favourably. A letter of application, including a curriculum-vitae, academic record, letter of support from the Head of School/Department and 2 referees' supporting statements, should be sent to GRDC Undergraduate Honours Scholarship, PO Box E6, Queen Victoria Terrace, Canberra ACT 2600 (06 2725528). Applications close late November.

# The Great Barrier Reef Marine Park Authority Research Support (I,L)

• \$1,500

Applicants must be undertaking a full-time Honours year or PhD research project that could contribute to the planning and managing work undertaken by the Great Barrier Reef Marine Park Authority. Applications and further information may be obtained from the Executive Officer, Great Barrier Reef Marine Park Authority, PO Box 1379, Townsville QLD 4810 (tel 077 818811). Applications close mid-December.

## The Mitsui Education Foundation Scholarship (L)

A one month scholarship to Japan is available to a young Australian national to help promote goodwill between the two countries. Candidates should be full-time undergraduate students aged between 20-24 and preferably in their third or fourth year. The successful student will travel to Japan during November and December. Application forms become available in June and close mid-July.

### The National Health and Medical Research Council (NH&MRC) Aboriginal Health Research Scholarships (L)

- \$22,250
- · Up to 3 years

Applicants may be undertaking an undergraduate degree in order to pursue research relevant to Aboriginal health. Applications close mid-July.

# The NSW Ministry for the Arts Scholarships (L, R, C)

• \$5,000 \$25,000 (depending on the award)

The NSW Government offers a number of scholarships and awards to writers, artists and scholars living in NSW. Further information is available from New South Wales Ministry for the Arts, GPO Box 5341, Sydney NSW 2000. Tel (02) 9228 3533, Fax (02) 9228 4722.

### The Pig Research and Development Corporation (PRDC) Undergraduate Encouragement Award (L)

\$600 lump sum

Applicants must be in the later stage of an undergraduate degree and interested in undertaking a research project related to the Australian pig industry. Applications close 3 times a year (ie 1 March, 1 July, 1 October).

# The River Basin Management Society Ernest Jackson Memorial Research Grants (I,L)

• Up to \$2,000

The scholarship is available to assist students undertaking research in the field of River Basin Management. Applications close on 11 August.

## The RSPCA Alan White Scholarship (I,L)

• \$2,500

Applicants should be undertaking original research to improve the understanding and welfare of animals. A letter of application should be sent to the Executive Officer, RSPCA Australia, PO Box E369, Queen Victoria Terrace, Canberra ACT 2600 (tel 06 2311437) by 31 March.

## The Sam Cracknell Memorial Scholarship (I,L)

- Up to \$1,500 pa
- 1 year

Applicants should have already completed at least 2 years of a degree or diploma course and be enrolled in a full-time course during the year of application. Selection is based on academic merit, participation in sport both directly and administratively and financial need. Applications close 31 March.

## The University Honours Year Scholarships (I,L)

- \$1,000
- 1 year

A number of scholarships will be awarded on the basis of academic merit for students entering an 'add-on' honours year, ie the honours year in a degree course which is normally a pass degree but which has the option of a further year of study at Honours level. Applications close 30 November.

## The W.S. and L.B. Robinson Scholarship (L)

- Up to \$6,500 pa
- 1 year renewable for the duration of the course subject to satisfactory progress

Applicants must have completed their schooling in Broken Hill or have parents who reside in Broken Hill. Applicants should be undertaking a course related to the mining industry, for example courses in Mining Engineering, Geology, Electrical and Mechanical Engineering, Metallurgical Process Engineering, Chemical Engineering and Science. A letter of application should be sent to Pasminco Mining, PO Box 460, Broken Hill, NSW 2880. Applications close 30 September.

# **Faculty of Applied Science**

## The RGC Scholarship in Economic Geology (L)

- \$5,000
- 1 year

The scholarship is available to a student entering Stage 4 of the Applied Geology course or an Honours year in Geology in the Science course and undertaking a field project relevant to economic geology. Letters of application and requests for information should be directed to RGC, Gold Fields House, 1 Alfred St, Sydney NSW 2000. Applications close 31 January.

# **Travel Scholarships**

# General

# The Arthur Anderson Study Abroad Scholarship (L)

• Up to \$2,500

The scholarship is to provide financial assistance to students in their second or third year of full-time study who wish to study abroad for one semester at an approved Asian university. The overseas study must count towards their UNSW degree. Students must satisfy the language and literacy requirements of the approved university. Candidates will be required to complete an application form at least four months prior to the commencement of the scholarship. Further information is available from the International Student Centre. Tel (02) 9385 5333.

## The Association of International Education Japan (AIEJ) Short-Term Student Exchange Promotion Program (Inbound) Peace and Friendship Scholarships (I,L)

- 50,000 yen (settling-in allowance), 100,000 yen per month, plus airfare
- · Ten months to one year

Applicants must be accepted by a Japanese university under a student exchange program agreement with UNSW. Students must initially apply directly to a Japanese university through the International Student Centre at UNSW. The Japanese host university will recommend candidates to AIEJ and students must apply as directed by the host university. Applications close in February, May and September each year.

### The Association of International Education Japan (AIEJ) Short-Term Student Exchange Promotion Program (Inbound) Scholarships (I,L)

- 50,000 yen (settling-in allowance), 80,000 yen per month, plus airfare
- Six months to one year

Applicants must be accepted by a Japanese university under a student exchange program agreement with UNSW. Students must initially apply directly to a Japanese university through the International Student Centre at UNSW. The Japanese host university will recommend candidates to AIEJ and students must apply as directed by the host university. Applications close in February, May and September each year.

## DAAD – The German Academic Exchange Service Scholarships (L)

Application forms for the following scholarships are available from the Consulate General of the Federal Republic of Germany, PO Box 204, Woollahra NSW 2025.

## **One-Semester German Studies Scholarships**

- DM1,000 a month living allowance, travel assistance of DM2,500 and the health insurance contribution
- One semester

Applicants must be in their third year of German Studies. Applications close 1 July.

## **Deutschlandkundlicher Winterkurs**

 DM3,500 to assist with travel and living expenses and course fees

Undergraduate and postgraduate students from all fields with at least two years University level German (with a better than B average) may apply for this scholarship. The students should be aged from 19 to 32 and proposing to undertake the 8 week (in January and February 1997) German studies course (in German) at the University of Freiburg. The course provides language instruction and concentrates on historical and cultural aspects of contemporary Germany for students with some knowledge of German and a background in German Studies. Applications close 1 August.

# The International Exchange Travel Scholarships (L)

- Up to \$1,500 pa
- 1 year

The scholarships were established to encourage UNSW students to participate in the University's formal international exchange programs. Students must be undergraduates embarking on a period of study overseas which will count toward their UNSW degree. Awards will be granted on the basis of academic merit. Interested students should contact the International Student Centre, tel (02) 9385 5333.

## The Mitsui Education Foundation Scholarship (L)

A one month scholarship to Japan is available to a young Australian national to help promote goodwill between the two countries. Candidates should be full-time undergraduate students aged between 20-24 and preferably in their third or fourth year. The successful student will travel to Japan during November and December. Application forms become available in June and close mid-July.

# The National Asian Languages Scholarship (L)

Students who have completed two years of tertiary level language study can apply to undertake advanced language study in Asia for 6 to 12 months. Applications close 15 September.

## The NSW Travelling Art Scholarship (L)

• \$25,000

The scholarship is available to an emerging visual artist to undertake a course of study or training overseas for one or two years. Guidelines and applications are available from NSW Ministry for the Arts, GPO Box 5341, Sydney 2001 (02 228 5533). Applications normally close in July.

# The Robert Sutton/ Jardine Matheson Scholarship (L)

• Up to \$1,000

This scholarship is available to provide an Honours year student, from either the Faculty of Commerce or from the Faculty of Arts, with assistance to undertake a semester of study in Asia which would count towards their degree. Further information is available from the International Student Centre.

## The Swiss Confederation Scholarships (L)

One scholarship may be available from The Swiss Confederation for art studies (for example, painting, graphic design, sculpture, music) in the 1997/1998 academic year. The scholarship will be awarded on the basis of academic merit and the possibilities for study in Switzerland. Applicants must have been born after 1 January 1962. The scholarship can only be allocated after the candidate has been accepted by a Swiss art school or conservatory. Applicants will be required to pass a language test in German or French. Applications close 1 December 1996.

## The STA Travel Grant (I,L)

• Up to \$3,000

Applicants must be undertaking study leading to a degree or diploma of the University and be members of the University Union. The grant is awarded on the basis of significant contribution to the community life of the University involving a leadership role in student affairs and the University Union and the relevance and merit of the proposed travel to the student's academic program or University Union activities. Applications close 30 April each year.

# **Graduate Scholarships**

Following are details of scholarships available to postgraduate students at UNSW.

The scholarships are listed by Faculty and course (eg scholarships in Science or Engineering) or whether they are available to undertake travel. If a scholarship is available to all students it will be listed in the General Scholarships section. For further information contact:

The Scholarships Unit The University of New South Wales Sydney 2052 Australia

Tel (02) 9385 3100/3101/1462 Fax (02) 9662 1049 E-mail: R.Plain@unsw.edu.au

# **General Scholarships**

Main programs of assistance for postgraduate study

# The Australian Postgraduate Awards (APA) (L, R)

- \$15,364 pa (1996 rate). Other allowances may also be paid
- Up to 2 years for a Masters, 3 years for a PhD degree. PhD students may apply for up to 6 months extension in certain circumstances

Applicants must have graduated, or be proposing to graduate in the current academic year, with Honours 1 or equivalent. The scholarships are available to undertake a Masters by Research or PhD. Students with Permanent Resident status must have lived in Australia continuously for 12 months. Applications close in late October.

# The Australian Development Co-operation Scholarship (ADCOS) (I, R, C)

- Tuition fees. Some students may be eligible for air fares and a stipend
- Determined by normal course duration

This award is for international students from selected countries only. Information should be obtained from Australian Diplomatic Posts or Australian Education Centres in the home country. Conditions and entitlements vary depending on the home country.

## The Overseas Postgraduate Research Scholarships (OPRS) (I, R)

- Tuition fees and medical cover only
- 2 years for a Masters, 3 years for a PhD

Eligibility is confined to postgraduate research students who are citizens of countries other than Australia or New Zealand. Applications close in late September.

# **Other General Scholarships**

# The Arthritis Foundation Research Scholarships (L, R)

- \$8,000 \$22,000 pa
- 1 year with a possible 2 year extension

Applicants must be enrolled in studies leading to a PhD or MD. Awards are offered for clinical, scientific and allied health professional research and professional education projects. Specific awards relate to studies of rheumatoid arthritis, osteoporosis, ankylosing spondylitis, lupus, scleroderma, fibromyalgia and Paget's Disease. Applications close with the Foundation in early June.

## The Australian Brewers Foundation Alcohol Related Medical Research Postgraduate Scholarships (I, L, R)

- Similar to the NH&MRC (see NH&MRC entry)
- 1 year

Similar to the NH&MRC. The scholarships are available to support research into the medical, social and public health aspects of moderate, hazardous or harmful alcohol consumption. Applications close in mid-September.

# The Australian Coral Reef Society (ACRS) Inc Student Grants (L, I, R, C)

\$1,000 (plus \$1,500 Walker prize for the best proposal)

The grant is open to students at any Australian University who are enrolled in a PhD or MSc involving research on coral reefs. Recipients must be a member of, or be willing to join the ACRS. Applications normally close in late November.

## The Australian Federation of University Women (L, I, R, C)

Each year the Federation offers to its members a number of awards for study in Australia and overseas. Details of awards are included in a booklet available from the Australian Federation of University Women Inc, 8th Floor, Dymocks Building, 428 George Street, Sydney NSW 2000 (tel 02 9232 5629).

## The Australian Institute of Nuclear Science and Engineering (AINSE) Postgraduate Research Awards (L, I, R)

- \$7,500 supplement to an APA or equivalent scholarship (see APA entry under General), plus allowances
- Up to 3 years

Applicants must be in receipt of an APA or equivalent scholarship and have completed (or expect to complete) a Bachelor of Engineering or Bachelor of Science with Honours. At least one quarter of the period of tenure must be spent at the Institute at Lucas Heights, NSW. Applications close in early December.

## The Australian and New Zealand Council for the Care of Animals in Research and Teaching (ANZCCART) Student Award (L, I, R, C)

• \$1,000 for attendance at the annual conference

Applicants can be postgraduate students from any discipline. The award provides assistance for a student to attend the annual conference. Applications are available from ANZCCART, PO Box 19, Glen Osmond, SA, 5064 (tel 08 303 7325). Applications close in July.

# The Australian Pain Relief Association and Australian Pain Society PhD Scholarship (L, R)

- \$16,750 pa plus allowances
- Up to 3 years (subject to satisfactory progress)

Applicants must hold an Honours 1 degree and be proposing to undertake a PhD in the mechanism, diagnosis, treatment or epidemiological features of acute or chronic (including cancer) pain. Further information and applications are available from the Australian Pain Society Secretariat, PO Box 629, Willoughby NSW 2068 (tel 02 9439 6744). Applications close in early November.

## The Australian Telecommunications and Electronics Research Board (ATERB) Postgraduate Scholarships (L, R)

- \$9,000 intended as a supplement to other awards
- 1 year with the possibility of renewal

Applicants must have graduated, or be proposing to graduate in the current academic year, with Honours 1 or equivalent. Preference will be given to applicants who are aged under 30 years as at 1 January and who are undertaking research in telecommunications transmission and terminal systems, telecommunications theory and applications, switching and signalling systems, software for telecommunications systems, integrated telecommunications and mobile communication. Applications are available from the Secretary, ATERB, PO Box 93, North Ryde, NSW 2113 (02 9887 8221). Applications normally close in late October.

# The BHP Asia Pac Scholarship at UNSW (I, C)

- \$10,000
- 1 year

The scholarship is open to citizens or permanent residents of Indonesia only. Applicants must be graduates of a recognised university who are eligible to enrol in a Master's by coursework degree at UNSW. The scholarship may be restricted to a particular coursework degree, to be determined. Selection will be based on academic merit, and the reasons for the proposed course of study, and may consider financial need. Applications close 31 October.

## The Community Health and Anti-Tuberculosis Association The Harry Windsor Biomedical and Medical Research Scholarship (L, R)

- \$22,250 pa (Medical postgraduates), \$15,364 \$19,827 pa (Biomedical Science graduates) plus allowances
- Up to 3 years

Applicants must be proposing to undertake medical research in the areas of tuberculosis, respiratory disease (particularly community aspects) or community health. Applications close in early August.

## The Cooperative Research Centre for Eye Research and Technology (CRCERT) Postgraduate Research Scholarship (L, I, R)

- \$15,321 \$19,827 pa (depending on the type of research)
- 3 years

The scholarship is available for full-time PhD studies in subjects such as optometry, microbiology, biochemistry, optics, materials science, polymer chemistry and immunology. Applicants should initially contact Dr Mark Wilcox, CRCERT, University of New South Wales, Sydney 2052 (02 9385 0222) for information about application procedures.

# The Clean Air Society of Australia and New Zealand Inc Postgraduate Research Award (L, I, R, C)

- \$5,000 pa
- I year, with a possible 1 year extension

The scholarship is open to students enrolled in a Masters degree program with a significant research component connected with air quality. Applications close in early February.

# The CSIRO Division of Fisheries Supplementary PhD Awards (L, R)

- \$10,000 pa
- Up to 3 years

This scholarship is a supplement to any primary scholarship (eg APA) for PhD study in marine studies, environmental studies, zoology, botany, broadly-based life sciences, economics and mathematics. Applications close in early March.

### The Dairy Research and Development Corporation (DRDC) Postgraduate Education Program (L. R)

Awards to undertake full-time postgraduate research degrees are available in a wide range of disciplines including dairy manufacturing, farm research, economics and marketing, and agricultural extension. New and experienced applicants are welcome to apply. Guidelines and applications are available from the Scholarships Unit or DRDC, PO Box 8000, Glen Iris VIC 3146 (03 9889 0577). Applications close 31 October.

## The Energy Research and Development Corporation (ERDC) Postgraduate Awards (L, R, C)

- \$21,000 pa plus \$3,000 operating expenses to the institution
- · Up to 3 years

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. Projects should be relevant to ERDC's objectives for its investments. Applications close in late September.

### The Garnett Passe and Rodney Williams Memorial Foundation Research Scholarships in Otolaryngology (L, I, R)

- \$15,364 pa for science graduates, \$22,850 pa for medical graduates, plus allowances
- · 3 years

The scholarships are available to medical or science graduates for research in Otolaryngology or in related fields of biomedical science. Applicants must be enrolled in a postgraduate degree in Australia or New Zealand. Information and applications are available from the Garnett Passe and Rodney Williams Memorial Foundation, Pelham House, 165 Bouverie St, Carlton VIC 3053. Tel (03) 9349 2622, Fax (03) 9349 2615. Applications normally close in August.

## The Gerontology Foundation Grant-In-Aid (L, I, R, C)

Up to \$5,000 for a specific research project

A Grant-In-Aid is awarded to students who have not had their work published in a refereed journal and who have not won any research grants in open competition. The grant supports a proposed scientific investigation topic specified by the Foundation. Information and applications are available from The Executive Officer, Gerontology Foundation of Australia Inc, PO Bex 199, Annandale NSW 2038. Applications normally close in late July.

## The Gowrie Scholarship Trust Fund (L, R, C)

- \$4,000 pa
- 2 years

Applicants must be members of the Forces or children (or grandchildren or lineal descendants) of members of the Forces who were on active service during the 1939-45 War.

Tenable at tertiary institutions in Australia and overseas. Applications close in early October.

## The Grains Research and Development Corporation (GRDC) Junior Research Fellowship (L, R)

- \$21,000 pa plus up to \$3,000 to the supporting institution, some conference/workshop attendance allowances
- Up to 3 years

Applicants must be undertaking full-time PhD studies in fields of high priority to the grains industry. Applications close in mid-October.

## The Great Barrier Reef Marine Park Authority Research Support (L, I, R)

• \$1,000

Applicants must be enrolled in a full-time PhD with a research project that could contribute to the planning and managing work undertaken by the Great Barrier Reef Marine Park Authority, and to the Reef's ecologically sustainable development. Studies may be in a variety of areas and can involve any aspect of the physical, biological, social, cultural, and economic environments of the Great Barrier Reef. Students proposing communication and extension-related studies can also apply. Applications and further information may be obtained from the Director, Research and Monitoring Section, Great Barrier Reef Marine Park Authority, PO Box 1379, Townsville QLD 4810 (07 7818811). Applications close in early December.

# The Harold G. Conde Memorial Fellowship (L, R, C)

- \$5,000 pa, subject to the availability of funds
- Up to 3 years

Applicants should be honours graduates. The Fellowship is a supplementary award to be held in conjunction with another scholarship and is for postgraduate study or research in a field related to the electricity industry. Applications close in early April.

# The International Wool Secretariat Postgraduate Scholarships (L, I, R)

- \$21,362 pa plus allowances
- Up to 3 years

The scholarships are tenable in Australian tertiary institutions or ,in exceptional circumstances, overseas. The major areas of research are soils and pastures- production and utilisation, sheep breeding, sheep parasites and diseases, wool harvesting, processing and product development, raw wool marketing, economic research and technology transfer in all of these areas. Applications close in mid-October.

# The June Opie Fellowship (L, I, R, C)

- NZD\$10,000
- 1 year

The award is administered by the University of Auckland and is available to citizens and permanent residents of Australia, Canada and New Zealand, and is designed as an incentive for students of high academic achievement who have a severe disability. It is primarily intended for those who plan to undertake postgraduate study with a view to preparing themselves for a role in the professions, in politics or more particularly in university teaching and research and who have disability issues as a continuing interest. Applications close with the University of Auckland in early October.

### Land and Water Resources Research and Development Corporation (LWRRDC) Postgraduate Research Scholarships (L, I, R)

- \$20,000 pa plus \$5,000 for operating expenses
- 2 years for Masters, 3 years for a PhD degree

General Research Scholarships are available for research that will lead to better management, sustainable use and conservation of land, water and vegetation resources in Australia. Irrigation Research Scholarships are specifically for research that will lead to better management, sustainable use and conservation of natural resources within the irrigation industries. Applications are available from the Scholarships Unit or LWRRDC, GPO Box 2182, Canberra ACT 2601 (tel 06 2573379). Applications close in early October.

### The Meat Research Corporation (MRC) Studentships and Junior Research Fellowships (L, R, C)

- \$14,961 pa for study in a Masters or Diploma, \$20,000 for a PhD in Australia or \$US17,500 for study overseas, plus airfares, insurance and allowances
- 2 years for Studentships (Masters or Diploma), 3 years for Junior Research Fellowships (PhD)

Applicants should be proposing to undertake research and training in "off-farm" disciplines of practical value to the Australian beef, sheep meat, goat meat and buffalo industries. Applications normally close in mid-August.

# The Menzies Research Scholarship in the Allied Health Sciences (L, R)

- Up to \$24,000 pa
- 2 years

The scholarship is awarded to stimulate research in the non-medical allied health disciplines. Applications close in mid-June.

# The Minerals Council of Australia Student Research Award (L, I, R)

 \$500 plus travel and accommodation for the Environmental Workshop

The award is open to scholars who have completed or are undertaking postgraduate studies, and is aimed at encouraging excellence in student research and communication in the field of environmental management related to mining. The award will be judged on a paper written for and presented at the Minerals Council of Australia's Environmental Workshop. Nominations usually close in early May.

# The National Drug Strategy (NDS) Postgraduate Research Scholarship (L, I, R)

- \$23,204 pa
- 1 year, with a possible 2 year extension

Scholarships are available to students undertaking PhD studies and aim to develop expertise in researching and evaluating non-biomedical approaches to the prevention and treatment of drug misuse. Selection is based on academic merit, work experience and the potential of the project. Applications close in mid-July.

## The National Health and Medical Research Council (NH&MRC) Aboriginal Health Research Scholarships (L, R)

- \$15,364 \$22,850 pa (depending on qualifications)
- Up to 3 years

Applicants must be undertaking a course which includes, or leads to, research relevant to Aboriginal health. Applications close in mid-July.

## The National Health and Medical Research Council (NH&MRC) Dora Lush Postgraduate Scholarships (L, R)

- \$15,364 pa (or \$19,307 for AIDS research, \$17,364 for special initiative scholars) plus allowances
- Up to 3 years

Applicants should have completed a Science degree with Honours, or equivalent, at the time of submission of the application. Students enrolled in the Honours year at the time of application are **not** eligible. Applications close mid-July.

## The National Health and Medical Research Council (NH&MRC) Medical and Dental Postgraduate Scholarships (L, R)

- \$22,850 pa plus allowances
- Up to 3 years

The scholarships are open to medical and dental graduates. Applications are particularly encouraged for postgraduate research in the following fields alcohol and substance abuse, prostate cancer, nursing and allied health services, breast cancer, dementia, schizophrenia, dentistry and dental services, injury and HIV/AIDS. Applications close in mid-June.

## The National Health and Medical Research Council (NH&MRC) Public Health Postgraduate Scholarships (L, R)

- \$22,000 pa (medical postgraduates), \$19,500 pa (other postgraduates), plus allowances
- Up to 2 years for Masters, and up to 3 years for a PhD

The scholarship is designed to enable postgraduate students to obtain formal academic training in public health research. Applications close in mid-June.

## The National Heart Foundation of Australia Postgraduate Medical and Science Research Scholarships (L, R)

- \$16,364 (science), \$22,250 (medical) plus \$1,200 departmental allowance
- 1 year, renewable up to 3 years

The scholarship is available for research in cardiovascular function, disease or related problems. Applicants must usually reside in Australia. Medical applications close in mid-May and Science applications close in early October.

### The National Tertiary Education Union (NTEU) Scholarship for the Study of Industrial Relations and Unionism in Australian Tertiary Education (L, I, R)

- \$5,000 pa
- Up to 3 years

Applicants must have made or intend to make an application for candidacy for a Masters by Research or PhD in a topic which covers some aspect of industrial relations, policy issues and/or unionism related to Australian tertiary education. Applications close in early November.

## The National Multiple Sclerosis Society of Australia Postgraduate Research Scholarships (L, R)

- Same as NH&MRC scholarship stipends for medical and biomedical graduates
- Up to 2 years

Scholarships are available to medical graduates (or to appropriately qualified science graduates or health professionals) enrolled in a postgraduate research degree. Applications close in mid-July.

# The NSW Ministry for the Arts Scholarships (L, R, C)

• \$5,000 \$25,000 (depending on the award)

The NSW Government offers a number of scholarships and awards to writers, artists and scholars living in NSW. Further information is available from New South Wales Ministry for the Arts, GPO Box 5341, Sydney NSW 2000. Tel (02) 9228 3533, Fax (02) 9228 4722.

## The Pig Research and Development Corporation (PRDC) Postgraduate Research Fellowship (L, R)

- \$25,000 pa plus allowances
- Up to 3 years

Applicants must be undertaking a PhD relevant to the increased competitiveness of the Australian pig industry. Applications close in mid-December.

## The Pig Research and Development Corporation (PRDC) Postgraduate Top-Up Scholarships (L, R)

 Up to a maximum of \$21,000 as a supplement to other scholarships, plus allowances

Applicants must be eligible for another scholarship and be undertaking research relevant to increasing the competitiveness of the Australian pig industry. Applications close in mid-December.

# The Re-Entry Scholarship for Women (L, I, R, C)

- \$15,364 pa (equivalent to the Australian Postgraduate Award)
- 1 year

Applicants must be women who have been out of full-time paid professional employment for a period time and who wish to take up or resume a full-time research or coursework program of postgraduate study. Priority will be given to applicants wishing to update their research skills or to those who wish to gain further experience in order to return to employment in industry, business or education. Applicants must be able to demonstrate a well-planned career path. A written application and curriculum vitae should be forwarded to the Scholarships Unit, UNSW. Applications close 31 October.

# The River Basin Management Society Ernest Jackson Memorial Research Grants (L, I, R)

• Up to \$2,000

The scholarship assists PhD and Masters students undertaking research in the field of river basin management. Applications usually close in May and November each year.

# The Ronald Henderson Postgraduate Scholarships (L, R)

- \$5,000 pa as a supplement to an APA
- Up to 2 years for Masters by Research, 3 years for a PhD

The scholarships are open to graduates who intend to commence Masters or PhD studies in social economics, and who obtain an Australian Postgraduate Award or equivalent university postgraduate awards. Applicants may be enrolled in economics, commerce or arts degrees. Information and applications are available from the Ronald Henderson Research Foundation, 5th Floor, 165 Flinders Lane, Melbourne VIC 3000. Tel:(03) 9654 8299, Fax: (03)

9650 7501, E-mail: lance@creativeaccess.com.au. Applications close in late October.

## The RSPCA Alan White Scholarship (L, I, R)

### • \$2,500

Applicants should be undertaking original research to improve the understanding and welfare of animals. Applications close in mid-March.

## The Rural Industries Research and Development Corporation (RIRDC) Postgraduate Scholarships (L, R)

- \$21,500 pa plus \$3,500 to the host institution
- Up to 3 years

The scholarships are available for postgraduate study in rural research and development in areas of interest to the Corporation. Applicants must hold an Honours 1 or 2/1 degree in an appropriate discipline. Applications from mature age students with rural industry experience are particularly encouraged. Applications close in early November.

## The Shell Postgraduate Scholarship (L, R)

- \$20,000 pa
- Up to 3 years

Applicants should intend to study a PhD in science, engineering, economics/commerce, computer science, or a closely related discipline. Applications close in mid-October.

## The Social Policy Research Centre (SPRC) Postgraduate Research Scholarship (L, I, R)

- \$15,364 pa (equivalent to the APA), plus allowances
- 3 years for a PhD

Applicants should have a Bachelors Degree with at least Honours 2/1 in any of the fields of study relevant to social policy. The successful candidate will be enrolled in a relevant School of the University but will undertake research at the Centre. Prospective applicants must contact the School in which they wish to enrol. Application packages are available from the SPRC Publications and Information Officer, Social Policy and Research Centre, UNSW (02 385 3833). Applications close late October.

# The State Librarian's Metcalfe Scholarship at UNSW (L, R, C)

· To be determined

The scholarship is open to suitably qualified librarian's for a Masters degree in the areas of librarianship, marketing or technology, in relevant Faculties at UNSW. Selection will be based on academic merit, outline for the proposed area of study and demonstrated interest in Librarianship. Applications normally close 30 November.

## The Sugar Research and Development Corporation (SRDC) Postgraduate Scholarships (L, R)

- \$22,000 pa plus \$3,000 to the host institution
- Up to 3 years

The scholarships are available to foster research in disciplines compatible with the SRDC's research priorities. Applications close in mid-September.

## The Telstra Research Laboratories Postgraduate Research Fellowship (L, R)

- \$11,000 pa supplement to an Australian Postgraduate Award (see APA entry under General)
- Up to 2 years for Masters by Research, up to 3 years for a PhD

Applicants must be undertaking a Masters by Research or PhD in electrical engineering, computer science or other appropriate discipline. Applicants must have completed or expect to complete an appropriate degree with Honours or the equivalent. Applications close in mid-September.

## The Wenkart Foundation Grants (L, I, R)

- Up to \$22,000 pa
- 2 years but may be renewed

Applicants must be undertaking full-time research in clinical, biomedical or health related clinical sciences. Applications close in mid-May.

# **Faculty of Applied Science**

School of Materials Science and Engineering

## The Sir Rupert Myers Postgraduate Scholarship in Materials Science and Engineering (L, I, R, C)

- \$5,000 pa
- 1 year, renewable up to 3 years

Applicants must hold an Honours degree in materials science or engineering, or a related field. The scholarships are available for study towards a postgraduate degree in the School of Materials Science and Engineering. Information is available from the School of Materials Science and Engineering, University of New South Wales, 2052. Applications close in December.

# **General Travel Scholarships**

# AAUW Educational Foundation International Fellowships (L, I, R, C)

- US\$15,065
- 1 year

The American Association of University Women (AAUW) offers Fellowships for full-time postgraduate study or research in the United States for one academic year. Applicants must be females who have earned the equivalent of a United States Bachelor's degree and who are not US citizens or permanent residents. Preference will be given to women who show prior commitment to the advancement of women and girls through civic, community or professional work. Members of the Australian Federation of University Women (AFUW) may also be eligible for AAUW-IFUW awards for advanced training at any overseas institution. Application packs are available from the Scholarships Unit or the AAUW Educational Foundation, 2201 N. Dodge St, Dept 67, Iowa City, IA 52243 USA. Applications close in late November.

# The ACSANZ Postgraduate Awards for Canadian Studies (L, I, R)

• \$3,000 towards a research trip to Canada

The Association for Canadian Studies in Australia and New Zealand will offer grants to postgraduate students wishing to undertake a short research trip to Canada. Applicants must be enrolled in Master's or Doctoral degrees at Australian or New Zealand universities, and grants will be for research into all areas of academic enquiry that have a distinctly Canadian orientation, for example in the humanities, social and political sciences and some branches of the health and environmental sciences. Enquiries and applications should be directed to the Academic and Cultural Relations Officer, Canadian High Commission, Commonwealth Avenue, Canberra, ACT 2600. Tel (06) 273 3844, Fax (06) 270 4083, E-mail: co.cnbra@cnbra01.x400.gc.ca

## The Asian Studies Library Awards (ASLA) (L, R)

• \$250 to \$800 in a lump sum

Applicants must be undertaking a Masters by Research or PhD. The award provides a contribution towards the travel costs to centres with Asian collections to undertake library research. Further information and application forms are available from the Project Co-ordinator, Asian Studies Library Awards, Collection Management Division, Library ANU, Canberra ACT 2600. Applications close in mid June.

## The Association of International Education Japan (AIEJ) Short-Term Student Exchange Promotion Program (Inbound) Scholarships (L, I, R, C)

- 50,000 yen (settling-in allowance), 80,000 yen per month, plus airfare
- Six months to one year

Applicants must be accepted by a Japanese university under a student exchange program agreement with UNSW. Students must initially apply directly to a Japanese university through the International Student Centre at UNSW. The Japanese host university will recommend candidates to AIEJ and students must apply as directed by the host university. Applications close in February, May and September each year.

## The Association of International Education Japan (AIEJ) Short-Term Student Exchange Promotion Program (Inbound) Peace and Friendship Scholarships (L, I, R, C)

- 50,000 yen (settling-in allowance), 100,000 yen per month, plus airfare
- · Ten months to one year

Applicants must be accepted by a Japanese university under a student exchange program agreement with UNSW. Students must initially apply directly to a Japanese university through the International Student Centre at UNSW. The Japanese host university will recommend candidates to AIEJ and students must apply as directed by the host university. Applications close in February, May and September each year.

# The Australian Bicentennial Scholarships and Fellowships Scheme (L, R, C)

- 4,000 pounds sterling
- At least 3 months

Applicants must be enrolled as postgraduate students at Australian higher education institutions and usually resident in Australia. Awards are available for study in the United Kingdom in any discipline. Applications close with the Executive Director, Australian Vice-Chancellors' Committee, GPO Box 1142, Canberra ACT 2601 in late October.

### The Australian Federation of University Women (AFUW) (L, I, R, C)

Each year the Federation offers to its members a number of awards for study in Australia and overseas. Details of awards are included in a booklet available from the Australian Federation of University Women Inc, 8th Floor, Dymocks Building, 428 George Street, Sydney NSW 2000 (02 9232 5629).

# The British Aerospace Australia Chevening Scholarship (L, R, C)

- Tuition fees, maintenance allowance, airfare
- 1 year

The scholarship is available to undertake an approved one-year MSc course in aerospace engineering at a British university. Applicants must hold, or expect to complete before October 1996, an Honours 1 or 2/1 degree. Application forms are available from the British Council, PO Box 88, Edgecliff NSW 2027. Tel (02) 9326 2022, fax (02) 9327 4868. Applications close late October.

## The British Chevening Scholarship (L, R, C)

- · Tuition fees, maintenance allowance and return airfare
- 3 months to 1 year

The awards are intended for outstanding graduates and young professionals with the potential to rise to senior positions in the private or public sectors and will contribute to Australian-British relations and understanding. The awards are tenable for postgraduate study at British universities. Application forms are available from the British Council, PO Box 88, Edgecliff NSW 2027, tel: (02) 9326 2022, fax (02) 9327 4868. Applications close in October.

# The Cambridge Australia Scholarships (including Packer Scholarships) (L, R)

- Tuition fees, airfare, maintenance allowance
- Up to 3 years

The scholarships are open to postgraduate students who have an Honours 1 degree from an Australian university, who have gained admission to Cambridge and who are successful in winning an Overseas Research Student Award (ORS) awarded by Cambridge, for PhD studies in subjects relevant to Australia's needs. Scholarship application forms should be requested from Cambridge when applying for admission. Information on how to apply is available from the Honorary Secretary, Australian Committee of the Cambridge Commonwealth Trust, c/o Dept of Classics, ANU, Canberra ACT 0200. Tel (06) 249 2913/8830, Fax (06) 249 5039. Applications for admission to Cambridge close 31 December and scholarship applications close 30 April in the following year.

# The Cancer Research Fellowship Programme (L, I, R)

- Travel expenses and living allowances
- 1 year

Applicants should be engaged in research in medical or allied sciences and intending to pursue a career in cancer research. The awards are tenable at the International Agency for Research on Cancer in France, or any other suitable institution abroad. Areas of research include epidemiology, biostatistics, environmental and viral carcinogenesis and mechanisms of carcinogenesis. Applications are available from the International Agency for Research on Cancer, 150 cours Albert-Thomas, 69372 Lyon Cedex 08, France, tel 72 73 84 85, fax 72 73 85 75. Applications normally close in December.

# The Commonwealth Scholarship and Fellowship Plan (CSFP) (L, R, C)

- Varies for each country. Generally covers travel, living, tuition fees, books and equipment, approved medical expenses.
- Usually 2-3 years depending on the country

CSFP provides opportunities for Commonwealth students to undertake advanced academic study in other

Commonwealth countries. Candidates should be Commonwealth citizens who are graduates. Applications close at different times depending on the country in which the study is proposed.

# The Coral Sea Scholarship (L, R, C)

- \$3,000 per month, plus \$2,500 travel entitlement
- Up to 3 months

The award is for applicants holding a tertiary qualification who are proposing study in the United States, to investigate a problem or opportunity relevant to Australian business or industry. Applicants must be Australian citizens (Permanent Residents are ineligible). Applications are available from the Program and Development Officer, Australian-American Foundation, GPO Box 1559, Canberra City ACT 2601 (06 247 9331). E-mail: lindy@aaef.anu.edu.au. Applications close 30 September.

## DAAD – The German Academic Exchange Service Scholarships (L, I, R, C)

Application forms and information (including closing dates) for the following scholarships are available from the Consulate General of the Federal Republic of Germany, PO Box 204, Woollahra NSW 2025.

## **One-Year Scholarships**

- Monthly allowance between DM1,000 and DM1,600, airfares, health and accident insurance, and tuition fees
- 1 year

Scholarships are available for graduate studies in Germany. Applicants must be aged 32 or under and hold a Bachelors degree (or equivalent). A working knowledge of German is required of those who study arts; others may receive additional language training prior to the commencement of the scholarship. Applications normally close in September.

## **Research Grants**

- Monthly stipend of DM1,600, health insurance contribution and travel assistance of DM2,500
- 2 to 6 months

PhD students can apply for assistance to undertake a short period of research in Germany. Applicants must be aged 32 or under.

# Information Visits by Groups of Professors and Students

Groups (minimum of 10 persons, maximum of 30 persons) of professors and students can apply for assistance to visit Germany with the intention of increasing the knowledge of specific German topics. The program offers support in making travel and study arrangements and may include some financial assistance (based on the length of the stay and the number of persons undertaking the study tour). The period of stay must be between 7 and 21 days. No tours will be organised for July or August.

# Deutschlandkundlicher Winterkurs

- Course fees, DM3,500 to assist with travel and living expenses, health insurance
- 8 weeks (3 January 21 February 1997)

Undergraduate and postgraduate students from all fields with at least two years university-level German may apply for this scholarship. Applicants must be Australian or New Zealand citizens, aged from 19 to 32 and proposing to undertake German studies course (in German) at the Albert-Ludwigs University of Freiburg. The course provides language instruction and concentrates on historical and cultural aspects of contemporary Germany for students with a background in German Studies. Applications usually close in early August.

# East West Center Graduate Degree Fellowship (L, I, R, C)

- Accommodation, monthly stipend of US\$600, tuition fees, health insurance plus allowances
- 12 months with a possible 1 year extension

The Fellowships are available for postgraduate study at the University of Hawaii, preferably at Masters level. Citizens of countries in Asia, the Pacific and the United States are eligible to apply. Potential applicants must request an application package direct from the East West Centre, Awards Services Officer, Burns Hall 2066, 1601 East-West Road, Honolulu Hawaii 96848-1601, USA. Tel 1 808 944 7735, Fax 1 808 944 7730. Information sheets only are available from the Scholarships Unit. Applications close in early October.

# Frank Knox Memorial Fellowships (L, R, C)

- \$US14,500 pa plus tuition fees and health insurance
- 1 year with the possibility of renewal for a further year.

Applicants must be undertaking, or near completion, of a postgraduate qualification at an Australian university. The scholarships are tenable at one of the graduate schools of Harvard University. Applications close in early October.

# The Fulbright Postgraduate Student Awards (L, I, R)

- Up to \$US24,000 depending on the type of award, with the possibility of other allowances (eg return airfares and tuition fees)
- 1 year

Applicants must be enrolled in a postgraduate degree at an Australian institution and wishing to undertake research at an American institution. Students planning to undertake an American higher degree in any field can apply for the **Fulbright Student Awards**. Students proposing to undertake study in engineering, visual and performing arts, statistics (and related disciplines) and the links between educational institutions, workplaces and communities or Aboriginal and Torres Strait Islander people can apply for the **Privately Sponsored Postgraduate Student Awards**. Students proposing study in an American Master of Business Administration can apply for the **David O**. **Anderson Scholarship** sponsored by the Chase Manhattan Bank Australia Ltd. Applicants for the David O. Anderson Scholarship should contact the Program Development Officer, AAEF, GPO Box 1559, Canberra ACT 2601 (06 2479331). Other applicants should contact the Honorary Secretary, Fulbright NSW State Selection Committee, Sydney University 2006 (02 93514464).

# The Golda Meir Scholarship (L, I, R, C)

- Tuition (some allowances may be paid)
- 1 year

The Golda Meir scholarships are available to graduates, with a major field of study in Jewish studies, religious studies, Israel studies or Middle East studies, who meet the relevant requirements for the Graduate Year Program at the Hebrew University's Rothberg School for Overseas Students. Application forms are available from the Australian Friends of the Hebrew University, 36 Hawthorn Road, South Caulfield VIC 3162 (tel 03 9272 5511).

# The Gowrie Scholarship Trust Fund (L, R, C)

- \$4000 pa
- 2 years

Applicants must be members of the Forces or children (or grandchildren or lineal descendants) of members of the Forces who were on active service during the 1939-45 War. Applications close in early October.

## The Harkness Academic Fellowships (L, R, C)

- · Some allowances and tuition fees for study in the USA
- 12-21 months

The Academic Fellowships cover academic study and research. Applicants should be active in the public, business or voluntary sectors with an outstanding record of achievement. Special consideration may be given to studies in health care and related community issues. Applications are available on written request from the Harkness Fellowship, PO Box 836, Belconnen ACT 2606. Applications close in early September.

## The Harkness Mid-Career Fellowships (L, R, C)

- Professional travel allowance
- 7-12 months

The Mid-career Fellowships are for study and practical experience. Applicants should be active in the public, business or voluntary sectors with an outstanding record of achievement. Special consideration may be given to studies in health care and related community issues. Applications are available on written request from the Harkness Fellowship, PO Box 836, Belconnen ACT 2606. Applications close in early September.

# The International Wool Secretariat Postgraduate Scholarships (L, I, R)

- \$21,362 pa plus allowances
- Up to 3 years

The scholarships are tenable in Australian tertiary institutions or, in exceptional circumstances, overseas. The major areas of research are soils and pastures- production

and utilisation, sheep breeding, sheep parasites and diseases, wool harvesting, processing and product development, raw wool marketing, economic research and technology transfer in all of these areas. Applications close in mid-October.

# Japanese Government (Monbusho) Research Scholarships (L, R)

- Monthly allowance, airfare, tuition fees plus other allowances may be payable
- Up to 2 years

The scholarships are tenable for research study at Japanese universities, in a field related to the applicants' first course of study. Applicants must be university graduates, under 35 years of age, who are willing to study the Japanese language. Applications normally close in late June.

# The Kobe Steel Postgraduate Scholarship (L, R, C)

- Maintenance allowance of at least 7,000 pounds sterling plus tuition fees and travelling expenses.
- Up to 2 years with the possibility of extension.

The scholarship is tenable at St Catherine's College, Oxford University. The scholarship will be awarded to outstanding individuals who display qualities of leadership, excellence in sport as well as academic ability. Students should have a past or future interest in Japan. Applications close in mid-October.

# The Lady Davis Fellowship Trust (L, I, R, C)

The Lady Davis Trust provides awards for study, research, or teaching at graduate, post-doctoral or professorial levels at the Hebrew University or the Technion (Israel Institute of Technology). Information is available from the Australian Friends of the Hebrew University, 36 Hawthorn Road, South Caulfield VIC 3162 (03 9272 5511). Applications normally close in November.

# The Lloyd's Register of Shipping Chevening Scholarship (L, R, C)

- Tuition fees, maintenance allowance, airfare
- 1 year

Two scholarships are available to graduates, of proven academic merit and leadership potential, to pursue a postgraduate course at a British university. One scholarship is for a one-year MSc course in Marine Engineering/Naval Architecture, and the other is for a one-year MSc course in Environmental Sciences. Applicants must hold, or expect to complete before October, an Honours 1 or 2/1 degree. Application forms are available from the British Council, PO Box 88, Edgecliff NSW 2027. Tel (02) 9326 2022, Fax (02) 9327 4868. Applications close late October.

## The Meat Research Corporation (MRC) Studentships and Junior Research Fellowships (L, R, C)

- \$14,961 pa for study in a Masters or Diploma, \$20,000 for a PhD in Australia or \$US17,500 for study overseas, plus airfares, insurance and allowances
- 2 years for Studentships (Masters or Diploma), 3 years for Junior Research Fellowships (PhD)

Applicants should be proposing to undertake research and training in "off-farm" disciplines of practical value to the Australian beef, sheep meat, goat meat and buffalo industries. Applications normally close in mid-August.

# The Menzies Scholarships (L, R, C)

The Menzies Scholarships are intended to provide funds for Australian citizens (aged 21 to 45) who wish to travel to Britain to undertake a course of research and to write a paper, on a subject of concern and importance to the relationship between the Australian and British communities. Tertiary qualifications are preferred but the awards are not restricted to graduates or students. Information and applications are available from the Australia-Britain Society, GPO Box 551, Sydney NSW 2001 (02 223 5244). Applications normally close in October.

# The NSW Ministry for the Arts Scholarships (L, R, C)

• \$5,000/\$25,000 (depending on the award)

The NSW Government offers a number of scholarships and awards to writers, artists and scholars living in NSW. Further information is available from New South Wales Ministry for the Arts, GPO Box 5341, Sydney NSW 2000. Tel (02) 9228 3533, Fax (02) 9228 4722.

# The Oxford Nuffield Medical Fellowship (L, R)

- Between 27,525 and 31,945 pounds sterling pa (subject to tax), plus travel expenses
- 2 years with a possible 1 year extension

The awards are available for research in a clinical medicine or medical science department of the University of Oxford. The appointee is required to return to Australia for at least 3 years to perform work similar to that carried out in the United Kingdom during the tenure of the Nuffield fellowship. Further information is available from Australian Academy of Science, GPO Box 783, Canberra City ACT 2601. Tel (06) 247 5777, Fax (06) 257 4620. Applications close in mid-March.

## Overseas Research Students Awards Scheme (United Kingdom) (L, I, R)

 Difference in tuition fees for a 'home' and an 'overseas' student

The ORS Scheme provides partial remission of tuition fees to overseas students of outstanding merit and research potential. The awards are open to graduates who will be commencing full-time research studies at a participating institution in the United Kingdom, and who will be liable to pay tuition fees at the overseas student rate. Information
and applications must be obtained directly from the Registrar or Secretary of the institution students are applying to in the United Kingdom. Applications normally close in April in the year of tenure.

## The Rhodes Scholarship (L, R, C)

- Not less than 6,900 pounds sterling pa, tuition fees and assistance with travel expenses
- · 2 years, with a possible 1 year extension

The scholarship is tenable at Oxford University. Applicants must be aged between 19 and 25 and have an honours degree or equivalent. Selection for the scholarship will be based on academic and personal achievements, including community spirit. Applications close in late August.

## The Robert Gordon Menzies Scholarship to Harvard (L, R, C)

- Up to \$25,000 towards tuition fees, living expenses or travel costs, students who enrol in the Harvard Business School may be eligible for an additional \$12,000
- 1 year

The scholarships are tenable at one of the graduate schools of Harvard University. Applicants must be postgraduates of an Australian tertiary institution who intend to return to Australia after studies at Harvard or to represent Australia overseas. The scholarships are awarded on the basis of academic excellence and personal qualities such as leadership and public duty. The successful applicant will be expected, when circumstances permit, to repay the scholarship in later years. Applications and additional information may be obtained from the Administrative Services Group, ANU, Canberra ACT 0200. Tel (06) 249 5444, E-mail: Jane.Sutton@anu.edu.au. Applications close at the end of December.

## The STA Travel Grant (L, I, R, C)

#### • Up to \$3,000

Applicants must be undertaking study leading to a degree or diploma of the University and a member of the University Union. The grant is awarded on the basis of significant contribution to the community life of the University involving a leadership role in student affairs and the University Union and the relevance and merit of the proposed travel to the student's academic program or University Union activities. Applications close in mid-April.

#### Yokahama Scholarship Awards (L, R, C)

- 120,000 yen per month undergraduate, 150,000 yen per month for postgraduate students, tuition fees, airfare plus allowances
- Up to 4 years (undergraduate), 1 year for Japanese language study, 2 years for a Masters, 3 years for a PhD

Applicants must have submitted their application to, or have been accepted by a Japanese university and be able to communicate in Japanese (or be willing to undertake intensive study of the Japanese language). Applicants in all disciplines are eligible except for medicine, veterinary science and dentistry. Scholarships will be granted subject to the applicant's final acceptance by the chosen Japanese university. Original application forms only will be accepted and are available from the Scholarships Unit or from the Yokahama Scholarship Foundation, tel (07) 5588 0842. Applications close with the Foundation in early October. 248 APPLIED SCIENCE

## Prizes

The following information summarises 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, school or department in which they are awarded. Law prizes are awarded only for students enrolled in the LLB or Jurisprudence courses.

Information regarding the establishment of new prizes may be obtained from the Student Information and Systems Office located on the Ground Floor of the Chancellery.

The scholarship information is normally provided in the following format:

- Amount
- Conditions

## **Undergraduate Prizes**

# The University of New South Wales (General category for Prizes)

#### The Sydney Technical College Union Award

\$400.00 and a bronze medal

Leadership in student affairs combined with marked academic proficiency by a graduand

#### **Human Rights Centre**

#### The UNSW Human Rights Centre Essay Prize

• \$400.00

The best research essay on a Human Rights topic by a student enrolled at the University of New South Wales proceeding to the award of a Bachelor degree

# School of Chemical Engineering and Industrial Chemistry

#### The Abbott Laboratories Pty Limited Prize

• \$200.00

The best performance in Year 4 of the Bachelor of Engineering degree course in Chemical Engineering

## The Australasian Corrosion Association (NSW Branch) Award

\$150.00 and a 1 year membership of the Association

The best performance in INDC3041 Corrosion in the Chemical Industry

#### The Australian Institute of Energy (AIE) Prize

• \$150.00

The best performance in a subject selected by the Head of School

## The Australian Paper Manufacturers Limited Prize

• \$200.00

The best performance in INDC3070 Instrumentation and Process Control 1 in the Industrial Chemistry degree course

## The Australian Paper Manufacturers Limited Prize

• \$200.00

The best performance in CHEN3070 Process Control in the Chemical Engineering degree course

## **The BHP Engineering Prize**

• \$150.00

The best performance in Year 3 of the Bachelor of Engineering in Chemical Engineering course

## The BOC Gases Prize

• \$200.00

Meritorious performance in CHEN4081 Design Project

#### The Bristol-Myers Prize

• \$150.00

Meritorious performance in CHEN4030 Safety and Environmental

## The Cargill Australia Prize

• \$500.00

The best performance in CHEN4120 Process Plant Management and Operation

## The Carlton and United Breweries Prize

• \$300.00

Meritorious performance in CHEN4120 Process Plant Management and Operation

## The Comalco Aluminium (Bell Bay) Prize

• \$250.00

Meritorious performance in CHEN4090 Research Project

## The Comalco Aluminium (Bell Bay) Prize

• \$250.00

The best performance in the Bachelor of Engineering in Chemical Engineering course

## The Comalco Aluminium (Bell Bay) Prize

• \$250.00

The best performance in CHEN4030 Safety and Environement

## The Dorr-Oliver Prize

• \$200.00

The best performance in CHEN3040 Separation Processes 1

## The Dow Corning Prize

• \$300.00

The best performance in CHEN4081 Design Project

## The Dow Corning Prize

• \$300.00

The best performance in CHEN4090 Research Project

## The Dow Corning / SCM Chemicals Prize

• \$500.00

The best performance in the Environmental Management component of CHEN4100 Professional Electives

## The Du Pont / Waste Service NSW Prize

• \$300.00

Meritorious performance in the Environmental Management component of CHEN4100 Professional Electives

## The Fuel Technology Staff Prize

• \$200.00

The best performance in FUEL4090 Fuel and Energy Research Project

## The Goodman Fielder Ingredients Prize

• \$250.00

The best performance in CHEN3090 Chemical Engineering Applications

## The Hoechst Australia Prize

• \$200.00

Meritorious performance in CHEN4120 Process Plant Management and Operation

## The Johnson Matthey Prize

• \$400.00

The best performance in the Industrial Chemistry degree course

## The National Starch & Chemical Prize

• \$500.00

The best performance in POLY3010 Polymer Science

## The RGC Prize

• \$200.00

The best performance in MINP4010 Hydrometallurgical Processes

## The RGC Prize

• \$200.00

The best performance in CEIC2010 Instrumental Analysis

## The Shell Prize

#### • \$100.00

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

#### • \$200.00

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**

• \$200.00

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**

#### • \$100.00

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

• \$200.00

The best performance in a subject selected by the Head of School

#### The Simon Carves Australia Prize

• \$200.00

Meritorious performance in CHEN4081 Design Project

#### The Simon Carves Australia Prize

• \$200.00

The best performance in CHEN3060 Process Plant Engineering

#### The Wattyl Australia / James Hardie Prize

• \$400.00

Meritorious performance in the Environmental Management component of CHEN4100 Professional Electives

#### The Western Mining Corporation Limited Prize

• \$150.00

The best performance in CHEN2050 Chemical Engineering Laboratory 1

## The Western Mining Corporation Limited Prize

• \$150.00

The best performance in CHEN3080 Chemical Engineering Laboratory 2

### School of Geography

#### The Jack Mabbutt Medal

A bronze medal

The best performance in the Year 4 Project in Applied Geography by a student in the Bachelor of Science degree course

#### The Jack Mabbutt Prize

• \$150.00

Best performance by a third year student proceeding to Geography at Honours level

## **School of Materials Science and Engineering**

#### The ACI Glass Packaging Prize

• \$200.00

Outstanding quality in an honours thesis in one of the areas of glass or glass-ceramics in the Bachelor of Engineering degree course in Ceramic Engineering

## The ANSTO Prize

• \$100.00

The best performance in year four in the Bachelor of Engineering degree course in Ceramic Engineering

#### The Austral Bricks Prize

• \$100.00

The best performance in year three in the Bachelor of Engineering degree course in Ceramic Engineering

#### The Australasian Ceramic Society Prize

• \$100.00

The highest overall course aggregate by a student completing the final year of the Bachelor of Engineering degree course in Ceramic Engineering

## The Australasian Corrosion Association (NSW) Prize

• \$150.00

The best performance in MATS1203 Materials and Design 2 by a student in the Bachelor of Metallurgical Engineering degree course

## The Boral Bricks Prize

• \$500.00

The best performance in MATS2273 Chemistry of Ceramic Processing, Unit 2, Technical and Non-Technical Ceramics in the Bachelor of Engineering degree course in Ceramic Engineering

### The Broken Hill Proprietary Company Prize

• \$1,000.00

The best performance in the Metallurgical Engineering degree course by a graduating student

#### **The Capral Aluminium Limited Prize**

• \$200.00

The best performance in a subject selected by the Head of School

#### **The Commercial Minerals Limited Prize**

• \$200.00

The best performance in MATS2133 Ceramic Raw Materials in the Bachelor of Engineering degree course in Ceramic Engineering

## The Ferro Corporation (Australia) Prize

• \$250.00

The best performance in MATS2123 Ceramic Process Principles 2 in the Bachelor of Engineering degree course in Ceramic Engineering

#### The Hugh Muir Prize

• \$275.00

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

• \$100.00

The best overall academic performance by a student in the second year of the Bachelor of Engineering degree course in Ceramic Engineering

#### The Institute of Metals and Materials Australasia Prize

• \$200.00and 1 year membership of the Institute

The best performance in a subject selected by the Head of School

## **The Laporte Minerals Prize**

• \$250.00

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 degree course in Ceramic Engineering

#### **The Max Hatherly Prize**

• \$275.00

The best performance in MATS1002 Microstructural Analysis

#### The Monier PGH Prize

• \$1,000.00

The best performance by a graduating student in the Bachelor of Engineering degree course in Ceramic Engineering

## The Morganite Insulating Products Pty Limited Prize

• \$200.00

The best performance in MATS2254 Ceramic Engineering Design by a student in the Bachelor of Engineering degree course in Ceramic Engineering

#### **The Sialon Ceramics Prize**

• \$100.00

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 award of the degree of Bachelor of Engineering in Ceramic Engineering

#### **The Taylor Ceramic Engineering Prize**

• \$150.00 and a plaque

The greatest overall amount of ingenuity shown in professional activities by a graduating student in the Bachelor of Engineering degree course in Ceramic Engineering

#### The Wallarah Minerals Prize

• \$100.00

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

 Books from WTIA valued at \$200.00 and a 1 year membership of the Institute

The best performance in MATS3484/MATS1164 Welding Science and Technology

## The Western Mining Corporation Limited Prize

• \$150.00

The best overall performance in Year 3 full-time (or its part-time equivalent) by a student in the Engineering or

Bachelor of Science (Technology) degree courses in Materials Science and Engineering

## The Western Mining Corporation Limited Prize

• \$150.00

The best overall performance in Year 4 full-time (or its part-time equivalent) by a student in the Bachelor of Metallurgical Engineering degree course in Process Metallurgy or the Bachelor of Science (Technology) degree course in Metallurgy

## **Department of Applied Geology**

## The CRAE Mapping Prize in Applied Geology

• \$250.00

The best performance in GEOL3031 Stratigraphy and Basin Analysis Geological Field Mapping Tutorial by a student in the Bachelor of Science degree course

## The CRAE Ore Deposits Prize

• \$200.00

The best overall performance in the 3rd year Economic Geology subject (GEOL3101), or in any subject or subjects which may be substituted therefore, by a student proceeding to the award of the degree of Bachelor of Science

## The F C Loughnan Prize in Applied Geology

• \$340.00

The best performance in Year 3 of the Geology component of the Bachelor of Science degree course

## The F C Loughnan Prize for First Year Geology

• \$100.00

The best performance in Year 1 of the Geology component of the Bachelor of Science degree course

## The Lorant Eotvos Prize

\$300.00 and a bronze medal

The best performance in GEOL4111 Advanced Geological Techniques by a student in the final year of the Bachelor of Science degree course in Applied Geology or the Bachelor of Science degree course in Applied Geology at Honours level

## **The Prospectors Supplies Prize**

A Brunton compass

Meritorious performance in the field work associated with the Second Year of course 3000 Applied Geology or course 2500 Geology

## The Structural Geology Field Prize

 \$100.00 and winner's name engraved on Perpetual Trophy

The best performance in the Third Year Structural Geology Field Tutorial by a student proceeding to the degree of Bachelor of Science in either Applied Geology or the Board of Studies in Science and Mathematics (Geology Program)

### **Department of Biotechnology**

## The Amersham Modern Techniques In Biotechnology Prize

• \$250.00

The best performance in BIOT3061 Modern Techniques in Biotechnology

#### The Burns Philp Foods Prize

• \$300.00

The best overall performance in the Bachelor of Science degree course in Biotechnology at Honours level

#### The Burns Philp Foods Prize

• \$300.00

The best performance in one of the Level 3 Biotechnology subjects BIOT3011 Biotechnology A BIOT3021 Biotechnology B BIOT3031 Microbial Genetics BIOT3061 Modern Techniques in Biotechnology by a student in the Bachelor of Science degree course

#### The Burns Philp Foods Prize

• \$300.00

The best performance in BIOT3100 Fermentation Processes in the Bachelor of Science degree course

## Department of Food Science and Technology

#### The Flavourfresh Food Prize

• \$400.00

The best performance in FOOD1310 Food Preservation by a full-time student in the Bachelor of Science course in Food Science and Technology

#### The Nestle Australia Limited Prize

• \$200.00

The best performance in FOOD1400 Project in the Bachelor of Science degree course in Food Science and Technology

## The Wilfred B S Bishop Prize

#### • \$75.00

The best overall performance in the Bachelor of Science degree course in Food Science and Technology by a student who has made a significant contribution to staff and student activities

## **Department of Mining Engineering**

#### The Stan Sawyer Memorial Prize

• \$400.00

The best performance in an Honours thesis on a topic relating to coal mining by a student in the Bachelor of Engineering degree course in Mining Engineering

#### The Western Mining Corporation Limited Melbourne Prize

• \$200.00

The best overall performance by a student in the Bachelor of Engineering degree course in Mining Engineering

## The Western Mining Corporation Limited Perth Prize

• \$150.00

The best overall performance by a student in third year of the Bachelor of Engineering degree course in Mining Engineering

# The Western Mining Corporation Limited Perth Prize

• \$150.00

The best overall performance by a student in the final year of the Bachelor of Engineering degree course in Mining Engineering

## **Department of Textile Technology**

#### The Charles Parsons Prize (Year 2 Textile Management)

• \$500.00

The best performance in Year 2 Textile subjects by a student proceeding to the degree of Bachelor of Science in Textile Management

# The Charles Parsons Prize (Year 2 Textile Technology)

• \$500.00

The best performance in Year 2 Textile subjects by a student proceeding to the degree of Bachelor of Science in Textile Technology

# The Charles Parsons Prize (Year 3 Textile Management)

• \$500.00

The best performance in Year 3 Textile subjects by a student proceeding to the degree of Bachelor of Science in Textile Management

## The Charles Parsons Prize (Year 3 Textile Technology)

• \$500.00

The best performance in Year 3 Textile subjects by a student proceeding to the degree of Bachelor of Science in Textile Technology

## The J B Speakman Prize

• \$50.00

The best undergraduate thesis in the final year of the Bachelor of Science degree course in Textile Technology or Textile Management

#### The Merck Sharp & Dohme (Australia) Pty Limited Prize

• \$150.00

The best performance in Level 3 Chemistry subjects in the Board of Studies in Science and Mathematics

### The R J Webster Prize

• \$250.00

The best performance throughout the Bachelor of Science degree course in Textile Technology or Textile Management

## The Textile Institute Prize

· 2 years free membership of the Textile Institute

The best performance in Textile Technology by a student in the Bachelor of Science degree course in Textile Technology or Textile Management

## Department of Wool and Animal Science

## The Bayer Animal Health Prize

• \$120.00

The best performance in Years 2 and 3 of the Bachelor of Science degree course in Wool and Pastoral Sciences

## The C R Luckock Prize

 Voucher drawn on Uni Co-op Book Shop valued at \$60.00

The best performance in Meat Science in the Department of Wool and Animal Sciences

#### **The National Farmers' Federation Prize**

• \$150.00

Excellent academic attainment by a graduating student in the Bachelor of Science degree course in Wool and Pastoral Sciences

#### The P R McMahon Memorial Prize

• \$100.00

Excellence in Wool Science in the Bachelor of Science degree course in Wool and Pastoral Science

#### The Parkes Wool Promotion Committee Prize

· Your name being added to a shield

The best performance in Practical Wool Studies in the Department of Wool and Animal Science

## **Centre for Petroleum Engineering**

#### The AusIMM/Santos Prize

• \$500.00

Best performance in Year 3 of the Bacheor of Engineering in Petroleum Engineering

#### The ESSO Australia Prize for an Outstanding Contribution in a Non-Technical Subject

• \$500.00

Best performer in Year 4 in the subject PTRL4010 Communication Skills and Business Practices for Engineers in the Bachelor of Engineering in Petroleum Engineering degree course.

## The ESSO Australia Prize for Excellence in a Core Technical Subject

• \$500.00

Best performer in Year 3 in the subject PTRL3001 Reservoir Rock Properties and Fluid Flow in Porous Media

#### The Shell Development (Australia) Pty Ltd Prize

• \$500.00

Best performance in the subject CHEN4030 Safety and Environment

## **Graduate Prizes**

School of Chemical Engineering and Industrial Chemistry

#### The Clean Air Society of Australia and New Zealand Prize in Atmospheric Pollution Control

• \$100.00

The highest aggregate in FUEL9810 Atmospheric Pollution Control and FUEL5920 Practical Aspects of Pollution Measurement and Control in a post graduate course in the School of Chemical Engineering and Industrial Chemistry

## **Department of Applied Geology**

## The Laric V Hawkins Prize

• \$500.00

The best field project report involving a substantial component of geophysics in a postgraduate program, Year 4 of the Applied Geology course, or an equivalent Honours program in the Science or Advanced Science course

## **Department of Food Science and Technology**

## The Spruson and Ferguson Patent and Trade Mark Prize

• \$250.00

The best performance in the Seminar presentation by a student proceeding to the degree of Master of Science or Doctor of Philosophy in the Department of Food Science and Technology

## **Department of Safety Science**

#### The Blackmores Ltd Prize for In Vitro Toxicology Laboratory Science

• \$250.00

Best performance in Chemical Safety and Toxicology (CSAT) laboratory based subject or project report on in vitro toxicology, by a student enrolled in a Diploma or Coursework Master's Degree in the Department of Safety Science.

## The Ergonomics Society of Australia (NSW) Prize

• \$100.00 and membership of the Society

The best overall performance in all prescribed Core subjects to all students who have completed the requirements to graduate with the award of either the Master of Applied Science (Ergonomics) or the Graduate Diploma in Ergonomics

### The MMI Insurance Prize for Introduction to Occupational Health

• \$250.00

The best performance in SAFE9260 Introduction to Occupational Health by a student in the Masters degree course or the Graduate Diploma degree course in Safety Science

#### The MMI Insurance Prize for Occupational Medicine

• \$250.00

The best performance in SAFE9262 Occupational Medicine by a student proceeding to the award of the degree of Master of Safety Science, Graduate Diploma in Safety Science or Graduate Diploma in Ergonomics

#### The MMI Insurance Prize for Principles of Ergonomics

• \$250.00

The best performance in SAFE9224 Principles of Ergonomics by a student who was enrolled in the Graduate Diploma or coursework Masters degree course offered by the Department of Safety Science

## The National Safety Council Prize

• \$100.00

The best performance in SAFE9211 Introduction to Safety Engineering in the Masters Degree or Graduate Diploma in Safety Science

## The National Starch & Chemical Prize

• \$200.00

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

\$250.00

To be awarded each year to the student enrolled in the Graduate Diploma 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 Graduate Diploma in Safety Science

Books to the value of \$200.00

The best overall performance by a student in the Graduate Diploma of Safety Science course

#### The Safety Institute of Australia (NSW Division) Bill Lessels' Memorial Prize for Master of Safety Science

Books to the value of \$200.00

The best overall performance by a student in the Master of Safety Science course

### **The Whiteley Industries Prize**

• \$200.00

The best performance in SAFE9263 Chemical Safety and Toxicology by a student proceeding to a Diploma or Master's degree in any postgraduate teaching program offered by the Department of Safety Science

## **Department of Textile Technology**

## The Malcolm Chaikin Prize

• \$200.00 and a bronze medal

An outstanding PhD thesis in the Department of Textile Technology

## The University of New South Wales • Kensington Campus

#### Theatres

Athol Lykke Theatre C27 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 MacAulev Theatre E15 Mathews Theatres 023 Parade Theatre E3 Physics Theatre K14 Quadranole Theatre E15 Rex Vowels Theatre F17 Science Theatre F13 Sir John Clancy Auditorium C24 Webster Theatre G15

#### Buildings

Applied Science F10 Arcade D24 Architecture H14 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 Heffron, Robert (Chemistry) E12 International House C6 John Goodsell (Commerce and Economics) F20 Kensington Colleges (Office) C17 Library (University) E21 Link B6 Main, Old K15 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

#### Pavilions E24

Philip Baxter College (Kensington) D14 Quadrangle E15 Sam Cracknell Pavilion H8 Samuels Building F25 Shalom College N9 Webster, Sir Robert G14 Unisearch House L5 University Union (Roundhouse) E6 University Union (Blockhouse) E6 University Union (Squarehouse) E4 Wallace Wurth School of Medicine C27 Warrane College M7

#### General

Aboriginal Resource & Research Centre E20 Aboriginal Student Centre A29 Accommodation (Housing Office) E15 Accounting E15 Admissions C22 Adviser for Prospective Students C22 Alumni Relations: Pindari, 76 Wentworth St, Randwick Anatomy C27 Applied Bioscience D26 Applied Economic Research Centre F20 Applied Geology F10 Applied Science (Faculty Office) F10 Archives, University E21 Arts and Social Sciences (Faculty Office) C20 Asia-Australia Institute: 45 Beach Street Coogee Audio Visual Unit F20 Australian Graduate School of Management G27 Banking and Finance E15 Biochemistry and Molecular Genetics D26 Biological and Behavioural Sciences (Faculty Office) D26 Biomedical Engineering F25 Biomedical Library F23 Biotechnology F25 Built Environment (Faculty Office) H14 Campus Services C22 Cashier's Office C22 Centre for Membrane Science & Technology F10, K14 Chaplains F4 Chemical Engineering and Industrial Chemistry F10 Chemistry F12 Civil Engineering H20 Co-op Bookshop E15

Commerce and Economics (Faculty Office) F20 Communications Law Centre C15 Community Medicine D26 Computer Science and Engineering G17 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 Equal Employment Opportunity: 30 Botany Street Randwick Examinations C22 Facilities Department C22, B14A Fees Office C22 Fibre Science and Technology G14 Food Science and Technology B8 French C20 Geography K17 Geomatic Engineering K17 German and Russian Studies C20 Graduate School of the Built Environment H14 Groundwater Management and Hydrogeology F10 Health Service, University E15 Health Services Management F25 History C20 Human Resources C22 Industrial Design G14 Industrial Relations and Organizational Behaviour F20 Information, Library & Archives Studies F23 Information Systems E15 Information Technology Unit F25 International Student Centre F9 IPACE Institute F23 Japanese Economic and Management Studies E15 Landscape Architecture K15 Law (Faculty Office) F21 Law Library F21 Legal Studies & Taxation F20 Liberal and General Studies C20 Library Lawn D21 Lost Property C22 Marine Science D26 Marketing F20 Materials Science and Engineering E8

Mathematics F23 Mechanical and Manufacturing Engineering J17 Media Liaison C22 Medical Education C27 Medicine (Faculty Office) B27 Microbiology and Immunology D26 Michael Birt Gardens C24 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 Psychology F23 Publications Section C22 Remote Sensing K17 Research Office: 34-36 Botany Street Randwick Safety Science B11a 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, Housing etc E15 Counselling E15 Students' Guild E15 Swimming Pool B4 Textile Technology G14 Theatre and Film Studies B10 Town Planning K15 WHO Regional Training Centre C27 Wool and Animal Sciences G14 Works and Maintenance B14A



## The University of New South Wales • Kensington Campus

## UNSW

This Handbook has been specifically designed as a source of detailed reference information for first year 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 Australian Graduate School of Management (AGSM) Australian Taxation Studies Program (ATAX) College of Fine Arts (COFA) University College, Australian Defence Force Academy (ADFA)

General Education

For fuller details about the University – its organisation; staff members; description of disciplines; scholarships; prizes and so on, consult the University Calendar (Summary Volume). For further information on student matters consult the UNSW Student Guide.