School of Science and Engineering

School of Science and Engineering

The School of Science and Engineering is made up of scholars and teachers dedicated to teaching, research and consultancy in a number of integrated disciplines which support specialised studies in Civil Engineering, Environmental Management, Exploration and Environmental Geology, Food Science and Technology, Mechanical/Electrical Engineering, Mining Engineering and Occupational Health and Safety.

The School of Science and Engineering aims to develop students who think critically and creatively, drawing together all areas of student activity and incorporating such innovations as project-based and experiential learning. The School also conducts consultancy, research and development work, seminars and industry training courses on areas relevant to the mission of the School.

Whilst many of our activities are based in laboratories and associated facilities at the Mt Helen Campus, many other activities occur in field situations and association with Industry. Field trips are conducted in locations including the School Rangeland Research Station at Nanya in far western NSW, and other locations such as the Otway Ranges, the Flinders Ranges and Broken Hill. As well, excursions are conducted to regional industries such as manufacturing and mining facilities, wineries and dairy processing industries. Features on the campus associated with the School include the Arboretum, Electronics, Power and Robotics laboratories, Fluids and Thermofluids laboratory, the Glasshouse complex, Soils and Minerals laboratories, and the Structures testing laboratory.

The General School Office is located at the head of the internal stairs in Building S. The School is located in E, F, G and S buildings and the Industry Science building

Head of School

Martin E Westbrooke	BSc *Lond.,* MSc *LaT.,* LittB *UNE*, PGCE, PhD *LaT.,* MIFA	*Professor*

Academic Staff

Stephen Hall	BSc(Hons) *Burningham*, MAppSc *WA School of Mines*, PhD *McGill*	*Assoc Prof*
Peter Aldred	BSc(Hons) *Melb.,* PhD *Melb.,* MAIFST	*Sr Lect*
Peter Dahlhaus	BAppSc, MAppSc *RMIT*	*Sr Lect*
Barry J Kentish	BSc(Hons), PGCE *Lond.,* MSc *Durh.,* MEd *Melb.*	*Sr Lect*
John P Murray	BSc, DipEd *Qld.*, MAppSc *BUC*	*Sr Lect*
Patrick T Prevett	BSc *Lond.,* LittB, DipTertEd *UNE*	*Sr Lect*
Michael A Tuck	BSc(Hons)(MiningEng) *Nott*., PhD *Nott*., FMVSSA, MAIME, MAUSIMM	*Sr Lect*
Graeme J Ambrose	BSc(Hons), PhD *LaT.*	*Lect*
Stephen P Carey	BSc(Hons) *Melb.*, PhD *Wis.*	*Lect*
Kim Dowling	BSc(Hons) *NSW*, GDipEnvMan *Deakin,* PhD *James Cook*	*Lect*
Shirani Gamlath	BSc(Hons) *Peradeniya,* MPh *Peradeniya,* PhD *Cranfield,* MAIFST	*Lect*
Trevor D Gourley	DipCE *BendigoIT*, BEng(Civil) *Monash*, GCertTertTeach *Ballarat*, MIEAust, CPEng	*Lect*
Graeme K Hood	BAppSc *BCAE*, DipTT *SCV Haw*, MEng *RMIT*, MAIP, MIEEE	*Lect*
Samudra Jayasekera	DipTech(Civil) *Moratuwa*, BEng(Civil)(Hons) *Swinburne UT,* GradCert(TTL) *Swinburne UT*	*Lect*
Stafford W McKnight	BSc(Hons) *Newcastle (NSW)*, CertTeach *STC*	*Lect*
Frank Vriesekoop	Dip (Bread&Pastry) *Amsterdam,* DipGenEd *Amsterdam,* Dip (Hospital&catering) *TheHague,* Dip(PrelimVTT)*Wageningen*, BSc (Food Tech)*VUT,* BSc (App Biol Biotech) *VUT,* PhD *Melbourne*	*Lect*
Ibrahim Sultan	BSc, MSc *Cairo*, PhD *W. Aust.*, MIEAust, MASME, MIEEE	*Lect*
Lara Wakeling	BAppSc(Hons) *Ballarat,* PhD *Qld.,* MRACI, MAIFST	*Lect*
Michael Wilson	BSc *Macq.,* MSc *Macq.,* PhD *Ballarat*	*Lect*

Associate Academic Staff

Brian Chappell	BSc(Eng), MEngSc, PhD *ANU*, DipAppSc(Geol), FAusIMM, MIEAust, CPEng
Paul Gullan	B.Sc(Hons) *Monash*, PhD *Monash*
Ian J McKee	BSc(Hons), PhD *NSW*, DipEd(Tert), AIME, MIM, FIEAust, CPEng
Ian R K Sluiter	BSc(Hons) *Monash*, PhD *Melb.*

Technical Staff

Bruce Armstrong	BAppSc(Hons) *Ballarat*	*Technical Assistant*
Paul G Bennett		*Laboratory Tech*
Wendy Cloke		*Laboratory Tech*
Neil W Hives	BSc(Hons), MSc *LaT.*	*Technical Officer*
Robert Smith		*Technical Assistant*
Julie Worrall		*Laboratory Tech*

Administrative Staff

Leanne Cocks	CertIII(OfficeAdmin) *Ballarat*	*Admin Assistant*
Suzanne Hynes	AssDipBus(OffAdmin) *SMB*, GDip Management *Ballarat,* ATEM	*Administration Manager*
Suzanne Lamb		*Admin Officer (Finance)*
Adrienne L Ryan	*SMB,* CertPerfArts *SMB,* CertVocStudies (Office/Finance)*SMB*	*Student Liaison Officer*
Sue E Taylor		*PA to Head*

Special Projects Staff

Paul Reynolds	BAppSc *Ballarat,* GDEd (Sec) *Ballarat*	*On Line Development Officer*
Stephanie Davison	BSc *James Cook Uni*. DipEd	*Science & Schools Project Officer*

Research, Higher Degree and Ethics Coordinators

Stephen Hall	BSc(Hons) *Burningham*, MAppSc *WA School of Mines*, PhD *McGill*	*Assoc Prof*

CENTRE FOR ENVIRONMENTAL MANAGEMENT

The Centre for Environmental Management is a Designated Priority Research Centre within the University of Ballarat. The Centre is active in research and consultancy in all aspects of Environmental Management for both Government and private organisations. The Centre staff include botanists, zoologists, ecologists, and land use planners and maintains close associations with a wide range of related professionals in other fields such as Social Science, Economics, Archaeology and Cultural Heritage Management. The Centre is a recognised leader in computer resources and mapping packages in environmental management.

Martin Westbrooke (Professor)	BSc *Lond,* MSc *LaT,* LittB *UNE,* PGCE, PhD *LaT,* MIFA	*Director*
Jim O'May	BArch *Melb.,* MEnvSc *Monash*	*Research and Consulting Manager*
Matthew Gibson	BAppSc *Ballarat*	*Research (GIS) Officer*
Stacey Gowans	BAppSc(Hons) *Ballarat*	*Research/Project Officer*
Claire Harding	BAppSc *Uni of SA,* BAppSc(Hons) *Ballarat*	*Research/Project Officer*
Janet Leversha	BAppSc *Ballarat*	*Assist. Research and Consulting Manager*
Robert Milne	BAppSc *Ballarat*	*Research/Project Officer*

VIOSH AUSTRALIA

The Asia-Pacific Centre for Teaching and Research in Occupational Health and Safety
A Centre within the School of Science and Engineering

VIOSH Australia coordinates a number of highly-regarded teaching programs in occupational health and safety, including what were Australia's first, and remaining best-known, tertiary OHS programs. VIOSH Australia also conducts industry training courses for various organisations and enterprises on contract. The research activities of VIOSH Australia are practically oriented towards solving occupational health and safety problems.

One of the philosophies of VIOSH Australia is that great benefits can be derived from "closing the gap" between what is already known and what is applied widely in the community. Many VIOSH Australia projects have been concerned with developing, implementing and monitoring occupational health and safety educational programs for specialists and non-specialists.

Dennis Else (Professor in OH&S)	BSc *Salford*, PhD *Aston*	*Director*
David M Borys	AssocDipAppSc(OHS) *Victoria UT*, GDipOHM *Ballarat* GCertEd *Ballarat*, MAppSc(OHS) *Ballarat*, FSIA	*Lect & Manager*
John Culvenor	BEng(Hons), *Ball*arat, GDipErg, GDipLabRelLaw, PhD, MSIA, MESA, MIEAust	*Hon. Senior Research Fellow*
Dianne Elshaug	DipBusAdmin *Ballarat*	*Admin Officer*
Susan Leggett	BAppSc(OHS), *RMIT*	*Project Officer*
Chrissie Stone	BA *Ballarat,* GCertEd *Ballarat,* CertIVOH&S *Ballarat*	*Coordinator Commercial Programs*

Associate Staff

Stephen Cowley	BSc(OHS)(Hons) *Aston*, MSc(OccHyg) *Lond*., GCertEd *Ballarat*, MSIA, MBOHS
Zig Plavina	MEIAust, CPEng
Andrea Shaw	International Baccalaureate (bilingual), BA(Hons) *Melb*., BSc *Melb*, MESA, AFAHRI
Derek Viner	BSc *Witw*, MSc *Cran.*
Eric Wigglesworth	DipEd *Leeds*, BSc *Leeds* MSc *Melb.,* DAppSc *Melb.,* MD hc. *Tas.,* FSIA

School of Science and Engineering Courses

Bachelor of Applied Science

COURSE COORDINATOR
Mr John Murray

ADMISSION REQUIREMENTS
Applicants must have satisfactorily completed VCE including prerequisite Units 3 and 4 one of Biology, Physics, or Chemistry; and a study score of at least 20 in mathematics (any).

All Year 12/VCE applicants must apply through VTAC. Non-Year 12 applicants applying through VTAC are encouraged to complete Form SI. Alternatively Non-Year 12 applicants can apply direct to the University through the Tertiary Access Scheme. Refer to the Admissions, Policy and Procedures section in this Handbook.

CREDIT POINTS
360

DURATION
3 years full-time or part-time equivalent

MODE
Semester (day)

COURSE OVERVIEW
The Bachelor of Applied Science aims to provide graduates with a program of study which will give them a competitive edge in obtaining employment in a variety of science disciplines, a training in science which gives graduates a foundation of knowledge and skills and a preparation for continued lifelong learning.

COURSE OBJECTIVES
The course is designed to:

- Attract students with diverse backgrounds in science and to enable them to enter careers in the focus disciplines of the School;
- Provide undergraduate programs which draw on the strengths developed over recent years in the areas of Environmental Management, Exploration and Environmental Geology, Food Science and Technology and Mineral and Manufacturing Metallurgy;
- Focus the programs on applied and vocational aspects and provide graduates with a competitive edge to enter the work force;
- Provide graduates who will service community needs in these four focus disciplines; and
- Forge and consolidate existing links with relevant local, regional and national community, industry and government organisations.

COURSE STRUCTURE
The BAppSc is a three year full-time course founded on some common first semester units of studies with the choice of at least one elective unit of study. The choice of program can be made on commencement or at the end of the first semester and in some cases at the end of the first year. Major programs of study are:

- Environmental Management;
- Food Science and Technology; and
- Exploration and Environmental Geology.

Recommended program structures in each of the three focus disciplines are presented on the basis that timetable guarantees will be made. Where students choose their own program within the course structure guidelines, no such guarantees will be made.

The overall course structure is presented below:

Year 1
Four 15 CP units per semester selected from the chosen program allowing at least 1 elective.

Years 2 & 3
A student's chosen program continues allowing at least 1 elective in each semester. Students may take science units as their electives. Electives may be chosen on the basis of program recommended lists. Alternatively, a free selection may be made. In all cases, students must consult with the relevant Program Coordinator. Recommended structures of the three BAppSc programs are listed below. Students may take at least one elective in the chosen program in any semester. These may be single electives or part of a sequence of electives, constituting a minor strand eg. in Computing. Details are provided in the program structures below.

ENVIRONMENTAL MANAGEMENT

PROGRAM COORDINATOR
Mr Barry Kentish

The Environmental Management program is a transdisciplinary approach using knowledge, skills and attitudes from a range of disciplines such as environmental science, ecology, zoology, botany, geology, philosophy, and the social and political sciences. It builds these different disciplines into a coordinated, coherent unit of knowledge applicable to solving problems and making decisions for the environment and community.

The program recognizes the need for the appropriate professional education of environmental managers in the new millennium. Knowledge, skills and attitudes presented during the course are embedded in the professional contexts where the graduate will ultimately be employed. Throughout the course emphasis is placed on developing professional skills encouraged and required by industry, government and commerce – skills such as learning how to solve problems; thinking laterally, logically and independently; creativity and flair; intellectual rigour and professional integrity; leadership and supervision skills; learning how to cooperate and work in a team; consideration of ethical practice; critical and evaluation skills; interpersonal skills; a willingness to learn and relearn; in addition to a range of communication techniques and methods.

Year 1

unit code	**Semester 1**	credit points
	Core:	
SE522	Environmental Management	15
SE560	Australian Ecosystems	15
	Plus 2 electives, from:	
SX511	Earth Science	15
SF511	Chemistry	15
	Or another approved elective.	
	Semester 2	
	Core:	
SE520	Australian Biota	15
SE532	Ecological Methods	15
MS501	Statistics	15
	Plus a elective from	
SX522	Landscape Evolution	15
	Or another approved elective	

Year 2

unit code	**Semester 1**	credit points
	Core:	
SE672	Geographic Information Systems	15
SE640	Australian Fauna	15
SE662	Pests Plants and Animals	15
	Plus an approved elective. A recommended elective is:	
SE653	Wetlands	15
	Semester 2	
	Core:	
SE622	Environmental Ethics & Philosophy	15
SE630	Population and Community Ecology	15
SE680	Australian Flora	15
	Plus an approved elective.	

Year 3

unit code	**Semester 1**	credit points
SE721	Protected Area Management	15
SE771	Survey and Assessment	15
	Plus two electives from the following:	
SE751	Flora Management	15
SE752	Forest Management	15
SE491	Catchment Management	15
	Or another approved elective.	
	Semester 2	
	Core:	
SE781	Environmental Management Project	15
SE722	Reserve Management	15
	Plus 2 electives from:	
SE741	Fauna Management	15
SE753	Rangeland Management	15
	Or another approved elective.	

EXPLORATION & ENVIRONMENTAL GEOLOGY

PROGRAM COORDINATOR
Dr Stephen Carey

This is an applied degree program for students with an interest in Earth Science who wish to pursue professional careers in mineral and oil exploration, extractive industries, environmental science and hydrology and other areas associated with the Earth Sciences.

The program's strong applied orientation is aimed at equipping students with the training and experience necessary to participate in the intellectual and economic life of Australia.

Year 1

unit code	**Semester 1**	credit points
	Core:	
SX511	Earth Science	15
	Plus three approved electives (Two Science plus one other).	45
	Semester 2	
SX521	Planet Earth	15
SX522	Landscape Evolution	15
SX523	Earth's Living History	15
	Plus an approved elective.	15

Year 2

unit code	**Semester 1**	credit points
	Core:	
SX628	Hydrology	15
SX618	Structural Geology	15
SX619	Sedimentology	15
	Plus an approved elective. A recommended elective is:	
SX601	Regolith Science	15
	Semester 2	
	Core:	
SX627	Economic Geology	15
SX617	Optical Mineralogy	15
SX629	Field Work Principles and Practice	15
	Plus an approved elective. Recommended electives are:	
SX630	Geological Data Analysis	15
SE670	Soil Science	15

Year 3

unit code	**Semester 1**	credit points
	Core:	
SX717	Petrology	15
SX718	Applied Geochemistry	15
SX719	Field Work	15
	Plus an approved elective. A recommended elective is:	
SX733	Engineering Geology	15
	Semester 2	
	Core:	
SX726	Applied Stratigraphy	15
SX728	Applied Geophysics	15
SX729	Project	15
	Plus an approved elective. Recommended electives are:	
SX732	Advanced Field Work	15
SX730	Analytical Techniques	15

NB:SX719 & SX729 available in either Sem. 1 or 2.

FOOD SCIENCE & TECHNOLOGY

PROGRAM COORDINATOR
Dr Peter Aldred

The Food Science and Technology program includes disciplines and skills such as chemistry, biology, engineering, sociology, and microbiology and is a vocational program which requires the application of theoretical knowledge and practical skills from a wide range of these disciplines. Professional development in this field relies upon a sound, functional grounding in applied science together with the skills needed to apply this science to practical situations.

The Bachelor of Applied Science (Food Science and Technology) is professionally accredited by the Australian Institute of Food Science and Technology (AIFST).

Year 1

unit code	**Semester 1**	credit points
SF552	Food Science and Nutrition	15
MS501	Statistics	15
SF511	Chemistry 1	15
	Plus an elective.	
	Semester 2	
SF512	Chemistry 2	15
SF532	Intro Microbiology	15
	Plus two approved electives. Recommended electives are:	
SF553	Food in Society	15
SF514	Nature of Food	15

Year 2

unit code	**Semester 1**	credit points
	Core:	
SF621	Food Processing Systems I	15
SF641	Food Analysis	15
SF631	Food Microbiology I	15
	Plus an approved elective. *Recommended electives are:*	
SF651	Applied Biochemistry	15
	Semester 2	
	Core:	
SF622	Food Processing Systems 2	15
SF642	Food Chemistry	15
SF632	Food Microbiology 2	15
	Plus an approved elective. *Recommended electives are:*	
SF653	Nutrition and Metabolism	15
SF514	Nature of Food	15

Year 3

unit code	**Semester 1**	credit points
	Core:	
SF721	Food Processing Systems 3	15
SF741	Advanced Food Chemistry	15
SF731	Fermentation Technology	15
	Plus an approved elective. *Recommended elective is:*	
SF752	Food Biotechnology	15
	Semester 2	
	Core:	
SF722	Product and Process Development	15
SF761	Food Quality Management	15
*SF771	Research Project	15
	Plus an approved elective. Recommended elective is:	
SF732	Malting and Brewing Science	15

***** *SF771 is also available in Semester 1.*

Bachelor of Applied Science (Food Science and Technology)/ Bachelor of Management

COURSE COORDINATOR
Mr John Murray

COURSE ADVISORS
Dr Peter Aldred (Food Science)
Ms Lindon Marks (Management)

ADMISSION REQUIREMENTS
As per admission requirements for each of the degrees.

CREDIT POINTS
540 : *Food Science - 240; Management - 240; Electives – 60*

DURATION
Equivalent of 4.5 years full-time. May be completed in 4 years by overloading by one unit per year (see course structure).

MODE
Semester (day)

COURSE OVERVIEW
The Bachelor of Applied Science (Food Science and Technology)/Bachelor of Management combined degrees provide students with the opportunity to undertake in-depth studies in the areas of Food Science and Technology and Management. For further information on the range of offerings from the Bachelor of Management, please refer to the Bachelor of Management entry in the School of Business section of this handbook.

Students graduating with the combined degrees receive two degree testamurs – one for each degree.

The course has been professionally accredited by the Australian Institute of Food Science and Technology.

COURSE OBJECTIVES
A key role in the food industry is that of the food scientist who develops and manages systems for efficient, safe and high quality food processing. Those students who combined their food science and technology skills with training in management and marketing will be the graduate that the food industry will be looking for to lead it into the new opportunities that will emerge in the future.

Year 1

unit code	**Semester 1**	credit points
SF552	Food Science and Nutrition	15
SF511	Chemistry 1	15
	B Management	15
	B Management	15
	Semester 2	
SF512	Chemistry 11	15
MS501	Statistics	15
	B Management	15
	B Management	15
	An elective	15

Year 2

unit code	**Semester 1**	credit points
SF621	Food Processing Systems I	15
SF641	Food Analysis	15
	B Management	15
	B Management	15
	An elective.	
	Semester 2	
SF532	Intro Microbiology	15
SF622	Food Processing Systems 2	15
SF642	Food Chemistry	15
	B Management	

Year 3

unit code	**Semester 1**	credit points
SF631	Food Microbiology	15
	B Management	15
	B Management	15
	B Management	15
	Semester 2	
SF632	Food Microbiology	15
	B Management	15
	B Management	15
	B Management	15
	An elective.	15

Year 4

unit code	**Semester 1**	credit points
SF721	Food Processing Systems 3	15
SF741	Advanced Food Chemistry	15
	B Management	15
	B Management	15
	An elective.	
	Semester 2	
SF722	Product and Process Development	15
SF761	Food Quality Management	15
SF771	Research Project	15
	An elective.	15

PROFESSIONAL RECOGNITION
Successful completion of these combined degrees will admit graduates as members of the Australian Institute of Food Science and Technology and relevant professional management associations depending on the majors chosen.

Bachelor of Applied Science (Honours)

COURSE COORDINATOR
Dr Graeme Ambrose

ADMISSION REQUIREMENTS
A three-year undergraduate degree in Applied Science with final year results of a Distinction grade average.

CREDIT POINTS
120

DURATION
1 year full-time or part-time equivalent

MODE
Semester (day)

COURSE OVERVIEW
The Honours program is offered by research. Prospective candidates must submit to their potential supervisor a research proposal for consideration. The research topic must be within a discipline or research area of the academic staff of the School. (Please refer to Higher Degrees by Research at the end of this section.)

COURSE OBJECTIVES
The course aims to:
- Provide students with the opportunity to increase their specialist knowledge of and develop their skills in their major field of interest in Applied Science; and
- Provide research training for students by developing their ability to identify and design research solutions and to organise and conduct research in an independent manner.

Students will develop the ability to critically analyse scholarly work conducted in Applied Science and assess the relevance of the existing knowledge base in their specialist field.

COURSE STRUCTURE
Candidates will be required to successfully complete:

unit code	**Semester 1**
SS817	Literature Review
SS815	Research Thesis
SS819	Elective
	Semester 2
SS818	Literature Review
SS816	Research Thesis
SS820	Elective

Bachelor of Engineering Science *(2002)*
(Civil Engineering) OR (Mechanical/Electrical Engineering) OR (Mining Engineering)

COURSE COORDINATOR
Dr Michael Tuck

ADMISSION REQUIREMENTS
Applicants must have satisfactorily completed VCE or equivalent. Specific requirements for the course include prerequisite Units 1 and 2 Mathematics (any), and Units 3 and 4 Mathematical Methods.

Applicants who have successfully completed Specialist Mathematics will be deemed to have a Equivalent National Tertiary Entrance Rank (ENTER) of 5 percentage points higher.

All Year 12/VCE applicants must apply through VTAC. Non-Year 12 applicants applying through VTAC are encouraged to complete Form SI. Alternatively Non-Year 12 applicants can apply direct to the University through the Tertiary Access Scheme. Refer to the Admissions, Policy and Procedures section in this Handbook.

CREDIT POINTS
360

DURATION
3 years full-time or part-time equivalent

MODE
Semester (day)

COURSE OVERVIEW
The Bachelor of Engineering Science course is an integrated design-oriented course which aims to produce creative, technically-competent professional engineering graduates who have knowledge of the social, environmental, economic and organisational aspects of their work.

The applied design theme has a distinctive industry focus targeting the mineral and food industries, as well as service-oriented private professional consultancy. The main characteristic of the curriculum is applied design in a systems context, which is encompassed by the three study majors. Students select from one of the following three elective sequences: Mechanical/Electrical, Civil Engineering, or Mining Engineering.

COURSE OBJECTIVES
This is a vocationally orientated course that provides students with the knowledge and skills that are necessary to obtain employment as an engineering technologist and to be admitted as an Engineering Technologist with the Institution of Engineers, Australia. The course also serves as a preparation for graduate studies in technology, business administration and other areas. Specifically the course provides students with a core of basic analytical and communication skills, common to all branches of engineering, and then permits students to undertake in depth study of either civil engineering (infrastructure), mining or mechanical/electrical engineering. In addition, students are equipped with a basic knowledge of the industrial and social environments in which they will function as engineering technologists.

A student who successfully completes the course should be able to demonstrate:
- basic knowledge and skill in analysis;
- a knowledge of the branch of engineering chosen as their major study of sufficient depth for the student to gain employment as an engineering technologist within their field of specialisation;
- an ability to analyse and propose solutions to technical problems in accordance with established practices and procedures;
- a high degree of written and oral communication skills;
- computer literacy;
- a capacity to adapt to changing circumstances and master new techniques;
- an aptitude to undertake further learning and study;

- a basic understanding of the operation of the industrial and social environments in which they will function;
- eligibility for admission as an Engineering Technologist of the Institution of Engineers Australia; and
- a knowledge of the principal journals and other major information sources relevant to their field of specialisation, and an ability to comprehend and utilise data from these sources.

The core-engineering units enable students to:

- Build a strong foundation of knowledge, skills and attitudes in the fundamentals of engineering and related sciences and mathematics;
- Develop knowledge, skills and attitudes through unifying themes that generate understandings of engineering as a whole rather than a fragmented, piecemeal understanding of separate parts;
- Develop knowledge, skills and attitudes appropriate to their field of study that they will continue to be able to apply in the range of work settings well into the future, despite the explosion of knowledge and the emergence of technologies that are relentlessly causing narrow, specific knowledge and skills to become redundant;
- Develop an industry focus as their interests and opportunities for employment become clearer, thus ensuring their qualifications will be recognised by industry and other employing agencies;
- Explore significant aspects of their chosen profession, particularly engineering design, in a practical, *hands-on* way, from the commencement of their study;
- Develop the capacities of lifelong learning and transferable/generic skills in an integrated fashion through the content and methodologies of the core and elective units of their study program;
- Increasingly take responsibility for their own learning through the implementation of student-centred, resource-based learning approaches.

The integrated design oriented core has the following emphasis throughout the years:

- Engineering principles and systems;
- Engineering and society, the environment and sustainable development;
- Engineering processes and technology;
- Design and systems engineering.

Values/Attitudes

- Enjoy the engineering design process;
- Recognise engineering as an exciting, interesting, creative and diverse career;
- Appreciate and be committed to the ethical standards of professional engineering;
- Appreciate that learning, including learning to be a professional engineer, is a life-long process;
- Appreciate other cultures and customs;
- Learn about themselves as learners and apply a developing repertoire of learning techniques to the solution of engineering design problems; and
- Appreciate the responsibilities of engineers in relation to the environment and sustainable development.

COURSE STRUCTURE

To qualify for the Bachelor of Engineering Science degree, a student must complete the specified units and structural requirements of the course and obtain 360 credit points (refer to the charts outlining the course structure).

Bachelor of Engineering Science (Civil Engineering)

Course Structure

Year 1

unit code	**Semester 1**	credit points
EK501	Engineering Design & Drafting	15
EK565	Fundamentals of Engineering (Statics)	15
EK570	Fundamentals of Engineering (Materials)	15
EK511	Fundamentals of Engineering (Calculus & Physics)	15
	Semester 2	
EK566	Fundamentals of Engineering (Dynamics)	15
EK580	Fundamentals of Engineering (Electricity & Magnetism)	15
EK590	Fundamentals of Engineering (Applied Mathematics 1)	15
EK502	Engineering Computing	15

Year 2

unit code	**Semester 1**	credit points
EK680	Fundamentals of Engineering (Applied Mathematics 2)	15
EK 690	Fundamentals of Engineering (Applied Mathematics 2)	15
SX511	Earth Science	15
EK 660	Fluids and thermofluids	15
	Semester 2	
EK670	OH&S	15
EK635	Engineering Surveying	15
EK638	Introduction to Civil Design	15
EK 637	Introduction to Civil Construction	15

Year 3

unit code	**Semester 1**	credit points
EK741	Structural Design & analysis	15
EK744	Water & Drainage Infrastructure	15
EK781	Geomechanics	15
EK791	Design Project 1	15
	Semester 2	
EK841	Waste & Wastewater Infrastructure	15
EK742	Transport Infrastructure	15
EK752	Structural design	15
EK792	Design Project 2	15

Approved Electives

CP514 Programming 1, SE622 Environmental Ethics & Philosophy, SE522 Environmental Management, EK670 Occupational Health & Safety, SE672 Geographical Information Systems, BA506 Accounting & Business Decisions, JN501 Management Principles, EK722 Engineering Management & Finance, SE491 Catchments Management, SX628 Hydrology.

Bachelor of Engineering Science (Mechanical/Electrical Engineering)

Course Structure

Year 1

unit code	**Semester 1**	credit points
EK501	Engineering Design & Drafting	15
EK565	Fundamentals of Engineering (Statics)	15
EK570	Fundamentals of Engineering (Materials)	15
EK511	Fundamentals of Engineering (Calculus & Physics)	15
	Semester 2	
EK566	Fundamentals of Engineering (Dynamics)	15
EK580	Fundamentals of Engineering (Electricity & Magnetism)	15
EK590	Fundamentals of Engineering (Applied Mathematics 1)	15
EK502	Engineering Computing	15

Year 2

unit code	**Semester 1**	credit points
EK680	Fundamentals of Engineering (Applied Mathematics 2)	15
EK 690	Fundamentals of Engineering (Applied Mathematics 2)	15
EK671	Electrical Circuits & Systems	15
EK660	Fluids and Thermofluids	15
	Semester 2	
EK670	OH&S	15
EK673	Engineering Design & CAD	15
EK645	Analysis of electrical machines and drives	15
EK640	Theory of Machines & Drives	15

Year 3

unit code	**Semester 1**	credit points
EK645	Analysis of Electrical Machines & Drives	15
EK750	Engineering design	15
EK891	Programmable Logic Controllers	15
EK791	Design Project 1	15
	Semester 2	
EK761	Fluid Dynamics	15
EK734	Analysis of Dynamic Systems 2	15
EK731	Electro-techniques	15
EK792	Design Project 2	15
EK 890	Professional Practice	0

Approved Electives

CP514 Programming 1, EK670 Occupational Health & Safety, BA506 Accounting & Business Decisions, JN501 Management Principles, EK722 Engineering Management & Finance, CP627 Programming 2, CP728 Advanced Programming. Three elective sequence: SF621 Food processing systems, SF622 Food processing systems 2, SF721 Food processing systems 3.

Bachelor of Engineering Science (Mining Engineering)

Course Structure

Year 1

unit code	**Semester 1**	credit points
EK501	Engineering Design & Drafting	15
EK565	Fundamentals of Engineering (Statics)	15
EK570	Fundamentals of Engineering (Materials)	15
EK511	Fundamentals of Engineering (Calculus & Physics)	15
	Semester 2	
EK566	Fundamentals of Engineering (Dynamics)	15
EK580	Fundamentals of Engineering (Electricity & Magnetism)	15
EK590	Fundamentals of Engineering (Applied Mathematics 1)	15
EK502	Engineering Computing	15

Year 2

unit code	**Semester 1**	credit points
EK680	Fundamentals of Engineering (Applied Mathematics 2)	15
EK 690	Fundamentals of Engineering (Applied Mathematics 2)	15
SX511	Earth Science	15
EK660	Fluids and thermofluids	15
	Semester 2	
EK884	Mine Power and Services	15
EK635	Engineering Surveying	15
EK676	Mining Technology	15
SX627	Economic Geology	15

Year 3

unit code	**Semester 1**	credit points
EK783	Underground Production Systems	15
EK784	Surface Mining Operations	15
EK881	Rock & Soil Mechanics	15
EK791	Design Project 1	15
	Semester 2	
EK883	Mine Ventilation	15
EK 753	Computer Applications in Mining	15
EK882	Mineral Processing	15
EK792	Design Project 2	15

Approved Electives:

CP514 Programming 1, SE622 Environmental Ethics & Philosophy, SE522 Environmental Management, EK670 Occupational Health & Safety, SE672 Geographical Information Systems, BA506 Accounting & Business Decisions, JN501 Management Principles, EK722 Engineering Management & Finance.

PROFESSIONAL RECOGNITION

The integrated Bachelor of Engineering course is accredited by Engineers Australia, and the Bachelor of Engineering Mining Engineering Major course is accredited by the Australian Institute of Mining and Metallurgy (AusIMM).

Bachelor of Engineering Science(*)/Bachelor of Computing *(2002)*

* (Civil Engineering) OR * (Mechanical / Electrical Engineering) * (Mining Engineering)

COURSE COORDINATOR
Dr Michael Tuck (Engineering)
Dr Phil Smith (Computing)

ADMISSION REQUIREMENTS
Applicants must satisfy the admission requirements of both courses and require the approval of the course coordinator of each course.

CREDIT POINTS
540 *Engineering 300; Computing 240*

DURATION
4 years full-time or part-time equivalent

MODE
Semester (day)

COURSE OVERVIEW
The Bachelor of Engineering Science course is an integrated design-oriented course which aims at producing creative, technically competent professional engineering graduates who have knowledge of the social, environmental, economic and organisational aspects of their work.

The combined degrees provide a competitive edge for graduates wishing to maximise their career prospects and position themselves for future interdisciplinary career paths.

There is an increasing trend for Universities to offer combined degrees, and there is an unmet demand from prospective students for such programs. The combined degree programs offered by the School of Engineering are aimed at attracting high quality students who have a high expectation of completing both degrees.

Students graduating with the combined degrees Bachelor of Engineering Science/Bachelor of Computing receive two degree testamurs - one for each degree.

Computers and computing systems are becoming more and more integrated into the daily lives of people, and particularly into the Engineering and corporate world. In many industries it is expected that Engineers will have a high level of understanding of, and skills in, computing.

The demand for graduates with these high levels of computing skills is increasing continually, and an Engineering graduate with these skills will have a competitive advantage in the market place compared to those with single discipline degrees. In particular, the field of information technology requires both engineering and computing skills.

COURSE OBJECTIVES
The objectives of this combined degrees course must be considered in the context of each of the individual degrees. The objectives of each of the individual degree programs should be consulted.

COURSE STRUCTURE
To qualify for the Bachelor of Engineering Science/ Bachelor of Computing degrees, a student must complete the specified units and structural requirements of the Engineering course as specified below, plus the additional required units for the Bachelor of Computing course.

Bachelor of Engineering Science (Civil Engineering)/Bachelor of Computing

Course Structure

Year 1

unit code	**Semester 1**	credit points
EK501	Engineering Design & Drafting	15
EK565	Fundamentals of Engineering (Statics)	15
EK570	Fundamentals of Engineering (Materials)	15
	And Computing Unit/s	
CP510	Intro to Operating Systems	15
CP514	Programming 1	15
	Semester 2	
EK566	Fundamentals of Engineering (Dynamics)	15
EK580	Fundamentals of Engineering (Electricity & Magnetism)	15
EK590	Fundamentals of Engineering (Applied Mathematics 1)	15
	And Computing Unit/s	
CP627	Programming 2	15

Year 2

unit code	**Semester 1**	credit points
EK680	Fundamentals of Engineering (Applied Mathematics 2)	15
EK 690	Fundamentals of Engineering (Applied Mathematics 2)	15
SX511	Earth Science	15
	And Computing Unit/s	
CP611	Database Management Systems	15
CE	Computing Elective	15
	Semester 2	
EK637	Introduction to Civil Construction	15
EK635	Engineering Surveying	15
EK638	Introduction to Civil Design	15
	And Computing Unit/s	
CP582	Network Protocols & Services	15

Year 3

unit code	**Semester 1**	credit points
EK660	Fluids and thermofluids	15
EK 741	Structural design and analysis	15
EK781	Geomechanics	15
	And Computing Unit/s	
CP515	Software Engineering 1	15
CP685	Network Operating Systems	15
	Semester 2	
EK 670	OH&S	15
EK742	Transport Infrastructure	15
EK752	Structural design	15
	And Computing Unit/s	
CP616	Software Engineering 2	15
CE	Computing elective	15

Year 4

unit code	**Semester 1**	credit points
EK 791	Design project 22	15
EK744	Water & Drainage Infrastructure	15
	And Computing Unit/s	
CP704	Professional development	15
CP 728	Advanced programming	15
CP 783	Project 1	15
	Semester 2	
EK841	Waste & Waste Water Infrastructure	15
EK 792	Design project 2	15
	And Computing Unit/s	
CP703	Systems Programming	15
CE	Computing Elective	15

Bachelor of Engineering Science (Mechanical/Electrical Engineering)/Bachelor of Computing

Course Structure

Year 1

Unit code	**Semester 1**	credit points
EK501	Engineering Design & Drafting	15
EK565	Fundamentals of Engineering (Statics)	15
EK570	Fundamentals of Engineering (Materials)	15
	And Computing Unit/s	
CP510	Intro to Operating Systems	15
CP514	Programming 1	15
	Semester 2	
EK566	Fundamentals of Engineering (Dynamics)	15
EK580	Fundamentals of Engineering (Electricity & Magnetism)	15
EK590	Fundamentals of Engineering (Applied Mathematics 1)	15
	And Computing Unit/s	
CP627	Programming 2	15

Year 2

unit code	**Semester 1**	credit points
EK680	Fundamentals of Engineering (Applied Mathematics 2)	15
EK 690	Fundamentals of Engineering (Applied Mathematics 2)	15
EK672	Engineering Thermodynamics	15
	And Computing Unit/s	
CP611	Database Management Systems	15
CE	Computing Elective	15
	Semester 2	
EK673	Engineering design and CAD	15
EK645	Analysis of electrical drives and machines	15
EK640	Theory of Machines & Drives	15
	And Computing Unit/s	
CP582	Network Protocols & Services	15
CE	Computing Elective	15

Year 3

unit code	**Semester 1**	Credit points
EK660	Fluids and thermofluids	15
EK733	Analysis of dynamic systems 1	15
EK 750	Engineering design	15
	And Computing Unit/s	
CP515	Software Engineering 1	15
CP685	Network Operating Systems	15
	Semester 2	
EK761	Fluid Dynamics	15
EK670	OH&S	15
EK 734	Analysis of dynamic systems 2	15
	And Computing Unit/s	
CP616	Software Engineering 2	15
CE	Computing Elective	15

Year 4

unit code	**Semester 1**	credit points
EK891	Programmable Logic controllers	15
EK791	Design project 1	15
	And Computing Unit/s	
CP704	Professional Development	15
CP 728	Advanced Programming	15
CP 783	Project 1	15
	Semester 2	
EK731	Electro-techniques	15
EK792	Design Project 2	15
	And Computing Unit/s	
CP703	Systems Proramming	15
CE	Computing Elective	15

Bachelor of Engineering Science (Mining Engineering)/Bachelor of Computing

Course Structure

Year 1

Unit code	**Semester 1**	credit points
EK501	Engineering Design & Drafting	15
EK565	Fundamentals of Engineering (Statics)	15
EK570	Fundamentals of Engineering (Materials)	15
	And Computing Unit/s	
CP510	Intro to Operating Systems	15
CP514	Programming 1	15
	Semester 2	
EK566	Fundamentals of Engineering (Dynamics)	15
EK580	Fundamentals of Engineering (Electricity & Magnetism)	15
EK590	Fundamentals of Engineering (Applied Mathematics 1)	15
	And Computing Unit/s	
CP627	Programming 2	15

Year 2

unit code	**Semester 1**	credit points
EK680	Fundamentals of Engineering (Applied Mathematics 2)	15
EK 690	Fundamentals of Engineering (Applied Mathematics 2)	15
SX511	Earth Science	15
	And Computing Unit/s	
CP611	Database Management Systems	15
CE	Computing Elective	15
	Semester 2	
EK635	Engineering Surveying	15
EK676	Mining Technology	15
SX627	Economic Geology	15
	And Computing Unit/s	
CP582	Network Protocols & Services	15
CE	Computing Elective	15

Year 3

unit code	**Semester 1**	Credit points
EK660	Fluids and Thermofluids	15
EK783	Underground Production Systems	15
EK784	Surface Mining Operations and Equipment	15
	And Computing Unit/s	
CP515	Software Engineering 1	15
CP685	Network Operating Systems	15
	Semester 2	
EK884	Mine Power and Services	15
EK883	Mine Ventilation	15
EK753	Computer Applications in Mining	15
	And Computing Unit/s	
CP616	Software Engineering 2	15
CE	Computing Elective	15

Year 4

unit code	**Semester 1**	credit points
EK881	Rock and Soil Mechanics	15
EK791	Design Project 1	15
	And Computing Unit/s	
CP704	Professional development	15
CP728	Advanced Programming	15
CP783	Project 1	15
	Semester 2	
EK882	Mineral Processing	15
EK792	Design Project 2	15
	And Computing Unit/s	
CP703	Systems Programming	15
CE	Computing Elective	15

** note: Students must complete work experience unit EK890 Professional Practice. Computing Electives – students must complete 2 x 2nd year computing electives and 2 x 3rd year computing electives.*

PROFESSIONAL RECOGNITION
Graduates will be eligible for admission to the Institution of Engineers Australia and the Australian Computer Society. With a suitable choice of computing units, students may also sit for the Novell Certified Network Administrator, and Certified Network Engineer examinations.

Bachelor of Engineering *(2001)*

No intake beyond 2001- refer to 2001 Handbook for Course information or contact the School of Science and Engineering.

Bachelor of Engineering *(Pre-1996)*

For information regarding the pre-1996 course, please refer to previous University Handbooks or contact the School of Engineering.

Bachelor of Engineering *(1996 - 2000)*

For information regarding the pre-1996 course, please refer to previous University Handbooks or contact the School of Engineering.

Bachelor of Engineering/ Bachelor of Commerce *(1996 - 2000)*

No intake beyond 2000- refer to 2000 Handbook for Course information or contact the School of Science and Engineering.

Bachelor of Engineering/ Bachelor of Computing *(2001)*

No intake beyond 2001- refer to 2001 Handbook for Course information or contact the School of Science and Engineering.

Bachelor of Engineering/ Bachelor of Management *(1999)*

No intake beyond 1999- refer to 1999 Handbook for Course information or contact the School of Science and Engineering.

Graduate Certificate of Brewing

COURSE COORDINATOR
Dr Peter Aldred

ADMISSION REQUIREMENTS
Candidates should hold a bachelor degree or a TAFE Diploma, or be able to provide evidence of completion of relevant workplace training. If participants in the course do not possess a formal qualification or have not participated in workplace training it would be expected that they would normally have a minimum of three years malting or brewing experience and provide a referee's report.

CREDIT POINTS
60 credit points

DURATION
The courses have been designed to enable students to complete one unit per semester. Maximum duration of enrolment shall be 4 years, except in special cases where permission to extend this is granted by the School of Science and Engineering Courses Committee.

MODE
All units will be by flexible delivery including on-line access with supplementary posted readings. All students will be required to attend one residential workshop, held once per year, normally in December.

COURSE OVERVIEW
The course is designed to provide students with an in-depth knowledge of the principles and practice of malting and brewing. The Graduate Certificate overviews the whole brewing process. It provides significant detail in the areas of raw materials, wort production, fermentation and analysis, which may be typically required for small scale breweries, suppliers of breweries, and allied industries.

COURSE OBJECTIVES
The objectives of the Graduate Certificate and Graduate Diploma of Brewing are:

- to develop a sound knowledge of core concepts in the malting and brewing industries and the practical application of that knowledge;
- define and describe the raw materials used in the production of beers;
- describe and explain the chemical, technological and mechanical operations occurring during wort production;
- describe and explain the importance of yeast culture management, propagation technology and fermentation during the production of beer and related products;
- define and describe analyses used in the chemical and sensory evaluation of beer; and,
- to provide students with lifelong learning skills such as accessing information, scientific and technical analysis, independent thought and problem solving.

COURSE STRUCTURE
The Graduate Certificate of Brewing is a course consisting of four, 15 credit point units

unit code		credit points
SF480	Brewing Raw Materials	15
SE481	The Brewing Process	15
SF482	Yeast and Fermentation	15
SF483	Malt and Beer Quality	15

Graduate Diploma of Brewing

COURSE COORDINATOR
Dr Peter Aldred

ADMISSION REQUIREMENTS
As for Graduate Certificate of Brewing

CREDIT POINTS
120 credit points

DURATION
The courses have been designed to enable students to complete one unit per semester. Maximum duration of enrolment shall be 4 years, except in special cases where permission to extend this is granted by the School of Science and Engineering Courses Committee

MODE
As for Graduate Certificate of Brewing

COURSE OVERVIEW
In addition to the above Course Overview for the Graduate Certificate of Brewing, the Graduate Diploma includes more detailed information in areas which are more relevant to the large scale brewing industry such as more diverse types of packaging, quality assurance and quality management, and detailed engineering principles of downstream processing.

COURSE OBJECTIVES
As for Graduate Certificate of Brewing (above) and in addition, the Graduate Diploma of Brewing will provide significantly more detail to enable student to:

- describe and explain the principles of engineering, instrumentation and process control in the malting and brewing industries;
- describe the theory and practice of post-fermentation unit operations;
- describe the processes involved in the packaging of beer in a variety of containers eg kegs, cans, bottles.

COURSE STRUCTURE
Upon successful completion of the Graduate Certificate, the student can elect to articulate into the Graduate Diploma that will consist of two, 30 credit point professional units.

unit code		credit points
	Graduate Certificate of Brewing PLUS	60
SF484	Packaging and Quality	30
SF485	Engineering and Downstream Processing	30

Graduate Certificate of Food Science

COURSE COORDINATOR
Mr Robert Greig

ADMISSION REQUIREMENTS
A three-year undergraduate degree or TAFE Associate Diploma plus experience, or an approved industry training program plus experience.

CREDIT POINTS
60 credit points

DURATION
6 months full-time or part-time equivalent

MODE
Block

COURSE OVERVIEW
This is an integrated course of study units for further education and skills enhancement in the area of Food Science and Technology. The content and delivery is specifically designed for people working in the food processing industry and the important disciplines of food science, food safety, quality management and food processing are covered in the curriculum.

COURSE OBJECTIVES
This course is designed to enable students to:

- Define and describe the interrelationships between Food Technology and Agricultural Science;
- Define and describe the interrelationships between natural and social systems within the Food Technology and Agricultural Science fields;
- Define and apply an integrated, problem-solving approach to operations in an industry setting;
- Apply systems-thinking techniques and problem-solving techniques; and
- Apply Good Manufacturing Practice across the industry.

COURSE STRUCTURE

unit code		credit points
SF433	Food Science	15
SE431	Food Processing Systems	15
SF432	Food Safety	15
SF434	Food Quality Management	15

PROFESSIONAL RECOGNITION
Graduates, who also have suitable industry experience, will be eligible for membership of the Australian Institute of Food Science and Technology.

Graduate Diploma of Land Rehabilitation *(2001)*

No intake beyond 2001- refer to 2001 Handbook for Course information or contact the School of Science and Engineering.

Graduate Diploma of Mining

COURSE COORDINATOR
Dr Michael Tuck

ADMISSION REQUIREMENTS
Relevant degree or diploma or lesser qualification with significant industrial experience.

CREDIT POINTS
120

DURATION
1 year full-time or 2 years part-time

MODE
Block part-time (full-time by special arrangement)

COURSE OVERVIEW
The course is designed for part-time study over a two-year period in the form of four full-time periods on campus of two weeks each, followed by assignments and practical work in the student's place of employment. Persons not wishing or not able to finish the course in minimum time may attend full or

half sessions once or twice per year until the required number of units have been completed. Completion in one year of full-time study is possible following consultation with the course coordinator.

Students must complete any eight units from the prescribed list to complete the course.

COURSE OBJECTIVES
The Graduate Diploma of Mining is intended as continuing education for scientists and engineers involved with the mining industry. It is expected to appeal particularly to civil, mechanical, electrical, chemical and construction engineers, geologists, metallurgists, surveyors and other professionals with an interest in mining practice.

COURSE STRUCTURE
The following units will be offered regularly, subject to sufficient class numbers. All units are completely independent and do not have to be taken in any particular order.

unit code		credit points
EG401	Mine Power Sup. & Drainage	15
EG402	Production Drilling & Blasting	15
EG403	Tunnelling & Mine Dev't	15
EG404	Undergr'nd Product'n Systems	15
EG405	Materials Handling & Hoisting	15
EG408	Company Economics & Finance	15
EG409	Rock Mechanics Applications	15
EG410	Ore Reserve Estimation	15
EG411	Surface Mining Op's & Equip't	15
EG413	Mine Safety & Environ. Eng	15
EG414	Mine Surveying	15
EG415	Environ. Mngmnt of Mines	15
SG401	Mining and Economic Geology	15
SM401	Mineral Processing	15

PROFESSIONAL RECOGNITION
The course has been accepted in some states as fulfilling all or part of the academic requirements for certain Mine Managers' Certificates. Students interested in this aspect should contact the department in their own state to determine which combination of units is most suitable for their needs.

Master of Engineering Technology

COURSE COORDINATOR
Dr Michael Tuck

ADMISSION REQUIREMENTS
To be eligible for admission to the program, candidates must possess a three-year degree in engineering, science or technology in the same field of study as their proposed specialism. Alternatively candidates must possess a four-year degree in engineering, from a college or university recognised by the National Office of Overseas Skills Recognition (NOOSR) as awarding degrees that are comparable to the education level of an Australian bachelor degree.

CREDIT POINTS
180

DURATION
The course will be one and a half years full-time or part-time equivalent.

MODE
Semester (day), Block Mode

COURSE OVERVIEW
This is a vocationally orientated course that provides students with the knowledge and skills that are necessary to obtain employment as an engineer and to be admitted as a Member with the Institution of Engineers, Australia. The course also serves as a preparation for further graduate studies in technology, business administration and other areas. Specifically the course provides students with advanced studies in a branch of engineering, either civil engineering, electrical engineering, mechanical engineering or mining engineering.

COURSE OBJECTIVES
A student who successfully completes the course should be able to demonstrate:

- basic knowledge and skill in analysis;
- a knowledge of the branch of engineering chosen as their major study of sufficient depth for the student to gain employment as an engineering technologist within their field of specialisation;
- an ability to analyse and propose solutions to technical problems in accordance with established practices and procedures;
- a high degree of written and oral communication skills;
- computer literacy;
- a capacity to adapt to changing circumstances and master new techniques;
- an aptitude to undertake further learning and study;
- a basic understanding of the operation of the industrial and social environments in which they will function;
- eligibility for admission as a Member of the Institution of Engineers Australia; and
- a knowledge of the principal journals and other major information sources relevant to their field of specialisation, and an ability to comprehend and utilise data from these sources.

COURSE STRUCTURE
To qualify for the Master of Engineering Science degree a student must complete the specified units and structural requirements of the Engineering course as specified overleaf.

Civil Engineering

Course Structure
Year 1

unit code	**Semester 1**	credit points
SX733	Engineering Geology	15
EK741	Structural Design and Analysis	15
EK871	Research Project 1	15
	Elective	15
	Semester 2	
EK846	Urban and Regional Planning	15
EK844	Infrastructure Design and Construction	15
EK872	Research Project 2	15
	Elective	15

Year 2

unit code	**Semester 1**	credit points
EK873	Research Project 3	30
	Elective	15
	Elective	15

Elective List
EK 670 Occupational Health and Safety, SX 628 Hydrology, EK 722 Engineering Management and Finance, EK 881 Rock and Soil Mechanics, SE 762 Soil Conservation, BA 401 Accounting and Finance, BE 921 Managing in Complex Environments, BM 401

Marketing, BN 921 Organisations: Behaviour, Structure, Processes, BN 928 Entrepreneurship.

Mechanical Engineering

Course Structure

Year 1

unit code	**Semester 1**	credit points
EK722	Engineering Mgt and Finance	15
EK831	Machine System Design	15
EK871	Research Project	15
	Elective	15
	Semester 2	
EK875	Vibrations Machine Dynamics	15
EK876	Design of Thermal Systems	15
EK872	Research Project 2	15
	Elective	15

Year 2

unit code	**Semester 1**	credit points
EK873	Research Project 3	30
	Elective	15
	Elective	15

Elective List

EK 670 Occupational Health and Safety, EK 877 Refrigeration and Air Conditioning, EK 878 Robotics, CP 728 Advanced programming, BA 401 Accounting and Finance, BE 921 Managing in Complex Environments, BM 401 Marketing, BN 921 Organisations: Behaviour, Structure, Processes, BN 928 Entrepreneurship, EK 879 Renewable Energy, EK 891 Programmable logic controllers, EK 892 turbomachinery, EK 893 microcontrollers.

Three elective sequence: SF 621 Food processing systems 1, SF 622 Food processing systems 2, SF 721 Food processing systems 3.

Mining Engineering

Course Structure

Year 1

unit code	**Semester 1**	credit points
SX733	Engineering Geology	15
EK821	Mine Planning and Scheduling	15
EK871	Research Project	15
	Elective	15
	Semester 2	
EK822	Advanced Mine Ventilation	15
EK823	Advanced Rock Mechanics	15
EK872	Research Project 2	15
	Elective	15

Year 2

unit code	**Semester 1**	credit points
EK873	Research Project 3	30
	Elective	15
	Elective	15

Elective List

EK 670 Occupational Health and Safety, EK 753 Computer Applications in Mining, EK 824 Advanced rock breakage, EK 885 Ore deposit evaluation, EG 408 Company Economics and Finance, EK 825 Mine Environmental Engineering, EG 413 Mine Safety and Environmental Engineering, BA 401 Accounting and Finance, BE 921 Managing in Complex Environments, BM 401 Marketing, BN 921 Organisations: Behaviour, Structure, Processes, BN 928 Entrepreneurship.

PROFESSIONAL RECOGNITION

The Master of Engineering Technology course is accredited by the Engineers Australia.

Master of Mining Engineering

COURSE COORDINATOR

Dr Michael Tuck

ADMISSION REQUIREMENTS

To be eligible for admission to the program, candidates must possess a three or four year degree in Mining Engineering, or have completed a Graduate Diploma of Mining from the University of Ballarat, the Western Australian School of Mines or the University of New South Wales. Alternatively candidates must possess a four-year degree in Mining Engineering, from a college or university recognised by the National Office of Overseas Skills Recognition (NOOSR) as awarding degrees that are comparable to the education level of an Australian bachelor degree. Candidates for admission must have demonstrated a high level of academic performance and must also comply with the University requirements for competency in written and spoken English.

Candidates for admission to the program are eligible to seek advanced standing in the course, in accordance with existing University regulations. For this course the maximum number of exemptions permitted will be four 15-credit point units. Studies used as the basis for claims for advanced standing must normally be graduate studies and must not have been used to meet the requirements of another award. They will normally have been completed within a period of five years prior to the date of application for advanced standing.

DURATION OF COURSE

The course will be one and a half years full-time or part-time equivalent.

MODE OF DELIVERY

Block Mode, Distance

COURSE OBJECTIVES

The course is designed to enable students:

- Explain fundamental Engineering concepts at an advanced level in selected Mining industry areas;
- Describe and explain technical systems in a wide range of Mining Engineering applications;
- Apply the visualisation of three-dimensional space to the solution of Mining Engineering design problems;
- Perform research and development tasks.
- Appreciate the responsibilities of Mining Engineers in relation to the environment and sustainable development.

COURSE STRUCTURE

To qualify for the Master of Mining Engineering degree a student must complete the specified units and structural requirements of the course as specified below.

unit code	Unit name	credit points
EK 871	Research Project 1	15
EK 872	Research Project 2	15
EK 873	Research Project 3	30

Students are to select 120 credit points (8 units) from a the following elective list:

EK 821 Mine Planning and Scheduling, EK 822 Advanced Mine Ventilation, EK 823 Advanced Rock Mechanics, EK 824 Advanced Rock Breakage, EK 825 Mine Environmental Engineering, EG 401 Mine Power Supply and Drainage, EG 402 Production Drilling and Blasting, EG 403 Tunneling and Mine

Development, EG 404 Underground Production Systems, EG 405 Materials Handling and Hoisting, EG 408 Company Economics and Finance, EG 409 Rock Mechanics Applications, EG 410 Ore Reserve Estimation, EG 411 Surface Mine Operations and Equipment, EG 412 Computer Applications in Mining, EG 413 Mine Safety and Environmental Engineering, EG 414 Mine Surveying, EG 415 Environmental Management of Mines, SG 401 Mining and Economic Geology, SM 401 Mineral Processing.

If units have been undertaken previously in the Graduate Diploma of Mining they are not eligible to be selected for study within the Master of Mining Engineering.

PROFESSIONAL RECOGNITION
The Master of Mining Engineering course is accredited by Engineers Australia.

Higher Degrees by Research

- **Master of Applied Science (MAppSc)**
- **Master of Engineering Science (MEngSc)**

This degree is awarded on the basis of a thesis demonstrating "command of the knowledge and skills pertinent to the area of investigation as well as a critical appreciation and understanding of the relationship of his or her own work to that of others". The prerequisite for enrolment is an Honours degree at least second-class honours level (or equivalent qualifications and/or experience). There is provision for transfer from master's to PhD candidature, with credit for the period spent as a master's candidate.
Enrolment can be on a full-time or part-time basis. A student works during candidature under the guidance of a principal supervisor appointed by the Research and Higher Degrees Committee on the recommendation of the School.

(Requirements for Masters degrees are currently being re-drafted. Contact the School for further information.)

- **Doctor of Philosophy (PhD)**

This degree is awarded on the basis of a thesis making a substantial contribution to knowledge and demonstrating an understanding of the relationship of the investigations undertaken to a wider field of knowledge. Whereas in most cases the thesis will be a text reporting research undertaken by the candidate, the regulations also allow for a thesis to be creative work supported by an exegesis. The minimum requirement for enrolment is an Honours degree at first class honours level (or equivalent qualifications and/or experience).

Enrolment can be on a full-time or part-time basis. While the expectation is that a PhD degree will be completed within 3 to 4 years full-time (or the equivalent in part-time study), it is possible to meet degree requirements over a shorter or longer period of enrolment. A student works during candidature under the guidance of a principal supervisor appointed by the Research and Higher Degrees Committee on the recommendation of the School.

Areas of research strength in which supervision is available in the School of Science and Engineering include:

- Environmental Management;
- Food Science and Technology;
- Metallurgy;
- Geology;
- Fermentation Technology;
- Energy and Resources;
- Dynamics and Systems;
- Visual Data and Communications;
- Hazard Management; and
- Occupational Health and Safety in the Mining Industry.

- **Doctor of Engineering Science (D.Eng Sci)**

The Doctor of Engineering Science is a Higher Degree that combines research and professional interests. The program involves completion of a thematically linked Field/Professional Practice based research projects, completion of advanced study units and preparation of a dissertation and publication portfolio relating to the work undertaken. A supervisory panel controls the program.

A Doctor of Engineering Science degree enables a graduate to undertake high level research in a wide range of employment areas. The minimum requirement for enrolment is a bachelors degree in the relevant discipline (or equivalent qualifications and/or experience) and a minimum of 5 years work experience in Engineering or a similar area.

Enrolment can be on a full-time or part-time basis. While the expectation is that a D.Eng Sci degree will be completed within 3 to 4 years full-time (or the equivalent in part-time study), it is possible to meet degree requirements over a shorter or longer period of enrolment.

Further Information

The Higher Degree Regulations for the University of Ballarat provide information about prerequisites for enrolment, procedures during candidature, and the examination process. A copy of these Regulations, as well as application forms for candidature and scholarships, may be obtained from the Office of Research, University of Ballarat, telephone (03) 5327 9608. Information about research topics and supervision may be obtained from the School Research, Higher Degrees and Ethics Coordinator, Associate Professor Stephen Hall, telephone (03) 5327 9354, facsimile (03) 5327 9240, or the Head of School, Professor Martin Westbrooke, telephone (03) 5327 9213, facsimile (03) 5327 9240.

VIOSH Australia Courses

Certificate IV in Occupational Health & Safety

COURSE COORDINATOR
Ms Chrissie Stone

ADMISSION REQUIREMENTS
- Nil, but it is recommended that participants be at least 20 years of age and have at least two years work experience.

CREDIT POINTS
Not Applicable

DURATION
12 months (500 student learning hours) part time

MODE
Block (two weeks in January or July)

COURSE OVERVIEW
The course is designed for busy people who have experience in OHS but who have not had the opportunity to undertake a tertiary course.

The course is conducted twice a year. It consists of two weeks of on-campus learning followed by approximately 420 student hours of off-campus work. During the off-campus period participants complete a series of assignments while undertaking their normal work. This is an effective way of gaining a high quality, well regarded qualification in OHS.

COURSE OBJECTIVES
The course is designed to enable students to:
- Demonstrate a sound knowledge of the legislative and regulatory framework relating to occupational health and safety;
- Describe and implement appropriate strategies for the management of occupational health and safety within organisations;
- Communicate effectively both orally and in writing;
- Describe and explain appropriate means of predicting, identifying, assessing and controlling occupational hazards;
- Demonstrate a sound knowledge of common hazards in the workplace and the means of predicting, identifying, assessing and controlling them;
- Access and use information resources in occupational health and safety.

COURSE STRUCTURE

Theme A	Occupational Health and Safety Management
Theme B	Control of Hazards

Graduate Certificate in Occupational Hazard Management

COURSE COORDINATOR
Mr David Borys

ADMISSION REQUIREMENTS
- A first degree, with appropriate major studies; or
- A diploma or equivalent award with appropriate major studies plus at least two years appropriate experience; or
- A Certificate IV award plus at least two years appropriate experience; or
- At least three years OHS management experience at an appropriate level and demonstrable ability to benefit from the course.

CREDIT POINTS
60

DURATION
1 year part-time

MODE
Block (three weeks in January & July)

COURSE OVERVIEW
The course is designed as a stepping stone to completion of the Graduate Diploma in Occupational Hazard Management. It is also a valuable qualification in its own right. The course is designed for people who have managerial responsibilities for Occupational Health and Safety (OHS) in their workplace, or for those who aspire to such positions.

The course provides a robust, integrated and multidisciplinary framework on which future knowledge can be built. The course produces self-directed learners who have the academic framework and skills to tackle new issues in OHS as they arise.

COURSE OBJECTIVES
The course is designed to enable students to:

Knowledge
- Explain the management of occupational health and safety within a systems framework;
- Understand the policy setting and the laws that regulate occupational health and safety;
- Explain the organizational sources of occupational ill-health;
- Understand organizational theory and its application to occupational health and safety;
- Explain occupational health and safety risk management in the context of an occupational health and safety management system;
- Explain the strategies for the prevention and control of occupational health and safety risks;
- Explain the interconnectedness of disciplines within the occupational health and safety field.

Skills
- Explain systems thinking as a framework for thinking about, managing and improving occupational health and safety;
- Critically analyse and improve occupational health and safety management systems;
- Use knowledge of law to assist organisations achieve legal compliance;
- Apply models to understand, investigate and prevent occupational ill-health;
- Use knowledge of organizational theory to assist organisations prevent occupational ill-health;
- Apply the risk management process to the identification, assessment and control of occupational health and safety risks;
- Identify hazards and the normal controls that act upon hazards;
- Apply qualitative and quantitative techniques to the assessment of risk;
- Identify, evaluate and advise on the mix of risk controls that are consistent with legislative requirements and best practice.

Values
- Value occupational health and safety as a means for improving the well being of all members of workplaces and communities at large;
- Respect the importance of occupational health and safety for the achievement of corporate goals;
- Value the importance of professional ethics;
- Value curiosity, probing questions and continuous learning;
- Value creativity and the power of imagination.

COURSE STRUCTURE
Year 1

unit code	**Session 1**	credit points
EV601	OHS Systems	15
BL474	OHS Law	15
	Session 2	
EV602	OHS Risk Management	15
EV603	Prevention and Control of OHS Risks	15

ARTICULATION
The Graduate Certificate OHM is equivalent to the first year of the Graduate Diploma OHM.

PROFESSIONAL RECOGNITION
Membership of:
- Safety Institute of Australia
- Australian Institute of Risk Management.

Graduate Diploma in Occupational Hazard Management

COURSE COORDINATOR
Mr David Borys

ADMISSION REQUIREMENTS
- A first degree, with appropriate major studies; or
- A diploma or equivalent award with appropriate major studies plus at least two years appropriate experience; or
- At least three years OHS management experience at an appropriate level and demonstrable ability to benefit from the course.

CREDIT POINTS
120

DURATION
2 years part-time

MODE
Block (three weeks in January & July)

COURSE OVERVIEW
The course is designed for people who have managerial responsibilities for Occupational Health and Safety (OHS) in their workplace, or for those who aspire to such positions.

The course provides a robust, integrated and multidisciplinary framework on which future knowledge can be built. The course produces self-directed learners who have the academic framework and skills to tackle new issues in OHS as they arise.

COURSE OBJECTIVES
The course is designed to enable students to:

Knowledge
- Explain the management of occupational health and safety within a systems framework;
- Understand the policy setting and the laws that regulate occupational health and safety;
- Explain the organizational sources of occupational ill-health;
- Understand organizational theory and its application to occupational health and safety;
- Explain occupational health and safety risk management in the context of an occupational health and safety management system;
- Explain the strategies for the prevention and control of occupational health and safety risks;
- Explain appropriate means for prioritizing and measuring occupational health and safety performance;
- Explain strategies for influencing organisations to improve occupational health and safety;
- Explain auditing in the context of an occupational health and safety management system;
- Explain knowledge creation, and its limitations, in the field of occupational health and safety;
- Explain the interconnectedness of disciplines within the occupational health and safety field.

Skills
- Explain systems thinking as a framework for thinking about, managing and improving occupational health and safety;
- Critically analyse and improve occupational health and safety management systems;
- Use knowledge of law to assist organisations achieve legal compliance;
- Apply models to understand, investigate and prevent occupational ill-health;
- Use knowledge of organizational theory to assist organisations prevent occupational ill-health;
- Apply the risk management process to the identification, assessment and control of occupational health and safety risks;
- Identify hazards and the normal controls that act upon hazards;
- Apply qualitative and quantitative techniques to the assessment of risk;
- Identify, evaluate and advise on the mix of risk controls that are consistent with legislative requirements and best practice.
- Develop, monitor and report on measures of occupational health and safety performance;
- Be able to influence organisations to improve occupational health and safety;
- Audit occupational health and safety management systems;
- Be able to synthesise and critically evaluate knowledge from across a range of disciplines in the context of occupational health and safety.

Attitudes/Values
- Value occupational health and safety as a means for improving the wellbeing of all members of workplaces and communities at large;
- Respect the importance of occupational health and safety for the achievement of corporate goals;
- Value the importance of professional ethics;
- Value curiosity, probing questions and continuous learning;
- Value creativity and the power of imagination.

COURSE STRUCTURE
Year 1

unit code	**Session 1**	credit points
EV601	OHS Systems	15
BL474	OHS Law	15
	Session 2	
EV602	OHS Risk Management	15
EV603	Prevention and Control of OHS Risks	15
	Session 3	
MG510	Measuring OHS Performance	15
EV604	Growiing Healthy Organisations	15
	Session 4	
EV605	Auditing OHS Risk Management	15
EV606	Dissertation	15

PROFESSIONAL RECOGNITION
Membership of:
- Safety Institute of Australia
- Australian Institute of Risk Management.

Master of Applied Science (Occupational Health & Safety)
(by Coursework)

COURSE COORDINATOR
Prof. Dennis Else

ADMISSION REQUIREMENTS
Applicants must have a University degree and suitable industrial experience for entry in Year 1 or have completed the University's GDipOHM and have industrial experience for entry into Year 3 of the Masters program.

CREDIT POINTS
240

DURATION
4 years part-time

MODE
Block (January & July)

COURSE OVERVIEW
The Master's program aims to produce good researchers and people who can publicly comment on occupational health and safety issues.

The Masters by Coursework is a four year, part-time program. The first two years of the Masters program is the Graduate Diploma in Occupational Hazard Management (or equivalent). The final two years of the program concentrate on the design and implementation of a research project.

COURSE OBJECTIVES
To produce good researchers and people who can publicly comment on occupational health and safety issues.

Knowledge
- Contemporary issues in occupational health and safety; and
- Multidisciplinary approaches to research.

Skills
- Problem solving;
- Rigorous, reflective scientific research;
- Retrieving and evaluating information;
- Working with industry and trade unions; and
- Writing seminar papers and journal articles.

Value
- Robust, systematic argument, backed by scientific evidence;
- Professional peer review of one's work;
- New ideas; and
- Practical application of ideas to industrial problems.

COURSE STRUCTURE
For the first two years of the Masters program please refer to the Graduate Diploma in Occupational Hazard Management course structure.

YEAR 3

unit code		credit points
EV810	The Critical Researcher	30
EV820	Research Methodology and Design	30

Year 4

unit code		credit points
EV830	Presentations	20
EV840	Thesis	40

PROFESSIONAL RECOGNITION
Membership of:
- Safety Institute of Australia
- Australian Institute of Risk Management.

Listed below are the accredited undergraduate units from the School of Science and Engineering that may be available as elective units to students enrolled in any University programs. Students should confirm availability with the School Administrative Officer.

unit code	**School of Science and Engineering Units**	credit points
EG401	Mine Power Supply and Drainage	15
EG402	Production Drilling and Blasting	15
EG403	Tunnelling & Mine Development	15
EG404	Underground Production Systems	15
EG405	Materials Handling and Hoisting	15
EG408	Company Economics and Finance	15
EG409	Rock Mechanics Applications	15
EG410	Ore Reserve Estimation	15
EG411	Surface Mining Operations & Equipment	15
EG412	Computer Applications in Mining	15
EG413	Mine Safety & Environmental Engineering	15
EG414	Mine Surveying	15
EG415	Environmental Management of Mines	15
EK501	Engineering Design & Drafting	15
EK502	Engineering Computing	15
EK511	Fundamentals of Engineering (Calculus and Physics)	15
EK565	Fundamentals of Engineering (Statics)	15
EK566	Fundamentals of Engineering (Dynamics)	15
EK570	Fundamentals of Engineering (Materials)	15
EK580	Fundamentals of Engineering (Electricity & Magnetism)	15
EK590	Fundamentals of Engineering (Applied Mathematics 1)	15
EK635	Engineering Surveying	15
EK637	Introduction to Civil Engineering Construction	15
EK638	Introduction to Civil Engineering Design	15
EK640	Theory of Machines & Drives	15
EK645	Analysis of Electrical Machines & Drives	15
EK660	Fundamentals of Engineering (Fluids & Thermofluids)	15
EK670	Occupational Health & Safety	15
EK671	Electronic Circuits and Systems	15
EK673	Engineering Design and CAD	15
EK676	Mining Technology	15
EK680	Fundamentals of Engineering (Solid Mechanics)	15
EK690	Fundamentals of Engineering (Applied Mathematics 2)	15
EK722	Engineering Management and Finance	15
EK731	ElectroTechniques	15
EK733	Analysis of Dynamic Systems 1	15
EK734	Analysis of Dynamic Systems 2	15
EK741	Structural Design & Analysis	15
EK742	Transport Infrastructure	15
EK744	Water & Drainage Infrastructure	15
EK750	Engineering Design	15
EK752	Structural Design	15
EK753	Computer Applications in Mining	15
EK761	Fluid Dynamics	15
EK781	Geomechanics	15
EK783	Underground Production Systems	15
EK784	Surface Mining Operations	15
EK791	Design Project 1	15
EK792	Design Project 2	15
EK821	Mine Planning and Scheduling	15
EK822	Advanced Mine Ventilation	15
EK823	Advanced Rock Mechanics	15
EK824	Advanced Rock Breakage	15
EK825	Mine Environmental Engineering	15
EK831	Machine System Design	15
EK834	Industrial Systems Control 2	15
EK841	Waste & Waste Water Infrastructure	15
EK843	Infrastructure Design & Construction 1	15
EK844	Infrastructure Design & Construction 2	15
EK845	Infrastructure Planning & Management 1	15
EK846	Infrastructure Planning & Management 2	15
EK871	Research Project 1	15
EK872	Research Project 2	15
EK873	Research Project 3	30
EK875	Vibrations and Machine Dynamics	15
EK876	Design of Thermal Systems	15

unit code	**School of Science and Engineering Units** *(continued)*	credit points
EK877	Refrigeration and Air Conditioning	15
EK878	Robotics	15
EK879	Renewable Energy	15
EK882	Mineral Processing	15
EK883	Subsurface Environmental Engineering	15
EK890	Professional Practice	0
EK891	Programmable Logic Controllers	15
EK892	Turbomachinery	15
EK893	Microcontrollers	15
EK894	Automated Systems Control	15
EK895	Industrial Data Communications	15
EK896	Industrial Electronics	15
EV601	OHS Systems	15
EV602	OHS Risk Management	15
EV603	Prevention and Control of OHS Risks	15
EV604	Growing Healthy Organisations	15
EV605	Auditing OHS Risk Management	15
EV606	Dissertation	15
EV810	The Critical Researcher	30
EV820	Research Methodology and Design	30
EV830	Presentations	20
EV840	Thesis	40
EV851	Studies in Occupational Hazard Management A	10
EV852	Studies in Occupational Hazard Management B	15
EV853	Studies in Occupational Hazard Management C	20
SE491	Catchment Management	15
SE520	Australian Biota	15
SE522	Environmental Management	15
SE532	Ecological Methods	15
SE560	Australian Ecosystems	15
SE622	Environmental Ethics and Philosophy	15
SE630	Population & Community Ecology	15
SE640	Australian Fauna	15
SE653	Wetlands	15
SE662	Pests Plants and Animals	15
SE670	Soil Science	15
SE672	Geographic Information Systems	15
SE680	Australian Flora	15
SE721	Protected Area Management	15
SE722	Reserve Management	15
SE741	Fauna Management	15
SE751	Flora Management	15
SE752	Forest Management	15
SE753	Rangeland Management	15
SE761	Aquatic Ecosystem Management	15
SE762	Soil Conservation	15
SE771	Survey and Assessment	15
SE781	Environmental Management Project	15
SF431	Food Processing Systems	15
SF432	Food Safety	15
SF433	Food Science	15
SF434	Food Quality Management	15
SF480	Brewing Raw Materials	15
SF481	The Brewing Process	15
SF482	Yeast and Fermentation	15
SF483	Malt and Brew Quality	15
SF484	Packaging and Quality	30
SF485	Engineering and Downstream Processing	30
SF511	Chemistry I	15
SF512	Chemistry 2	15
SF514	Nature of Food	15
SF532	Introductory Microbiology	15
SF552	Food Science & Nutrition	15
SF553	Food in Society	15
SF621	Food Processing Systems I	15
SF622	Food Processing Systems 2	15
SF631	Food Microbiology 1	15
SF632	Food Microbiology 2	15

unit code	**School of Science and Engineering units** *(continued)*	credit points
SF641	Food Analysis	15
SE642	Food Chemistry	15
SF651	Applied Biochemistry	15
SF653	Nutrition and Metabolism	15
SF721	Food Processing Systems 3	15
SF722	Product and Process Development	15
SF731	Fermentation Technology	15
SF732	Malting and Brewing Science	15
SF741	Advanced Food Chemistry	15
SF752	Food Biotechnology	15
SF761	Food Quality Management	15
SF771	Research Project	15
SX511	Earth Sciences	15
SX521	Planet Earth	15
SX522	Landscape Evolution	15
SX523	Earth's Living History	15
SX601	Regolith Science	15
SX617	Optical Mineralogy	15
SX618	Structural Geology	15
SX619	Sedimentology	15
SX627	Economic Geology	15
SX628	Hydrology	15
SX629	Field Work Principles & Practice	15
SX630	Geological Data Analysis	15
SX631	Palaeontology	15
SX717	Petrology	15
SX718	Applied Geochemistry	15
SX719	Field Work	15
SX726	Applied Stratigraphy	15
SX728	Applied Geophysics	15
SX729	Project	15
SX730	Analytical Techniques	15
SX731	Exploration and Mining Geology	15
SX732	Advanced Field Work	15
SX733	Engineering Geology	15