

Bachelor of Agricultural Science

First-year subjects

202-101 Chemistry for Land and Food Resources

Note: Students intending to subsequently undertake Chemistry 610-142 must achieve at a high level in the examination component of this subject. They will also be required to complete additional computer-aided learning tasks during the winter break.

Availability: Parkville campus

Credit points: 12.5

Coordinator: Mr John Pilkington

Contact: Thirty-six hours of lectures and 36 hours of practicals/tutorials (*Semester 1*).

Description: The subject will cover areas including:

- nature of matter: elements, atoms, ions and molecules;
- electronic structure of atoms and ions;
- bond formation including covalent, ionic, metallic, hydrogen bonding, van der Waal's;
- solubility and the solution state; ions and hydration;
- the behaviour of gases;
- the mole concept, concentrations and stoichiometry;
- acids, bases, neutralisation reactions and salt formation;
- acid/base strength and the pH scale;
- energy and chemical systems;
- rates of reaction and reaction order;
- catalysis and enzymes;
- chemical equilibrium: the equilibrium constant, K_a , K_b , stability constants and solubility products;
- redox reactions and redox potentials;
- organic molecules: structure, nomenclature and functional groups;
- hydrophobicity and hydrophilicity; and
- biologically significant macromolecules.

Assessment: A three-hour exam (60%) and three short tests conducted during classes (worth 15%, 15% and 10%).

Recommended texts: S S Zumdahl and S A Zumdahl, *Chemistry, 6th edn*, Houghton Mifflin, 2003.

610-141 Chemistry A

See full subject details on page 2.

202-103 Biology for Land and Food Resources

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Cas McLean

Contact: Thirty-six hours lectures, 36 hours of practicals/tutorials (*Semester 1*).

Description: The subject introduces students to biological concepts and skills which will form the foundation of other 'biology-based subjects'.

The subject covers areas including:

- cell biology and metabolism: molecules of life - water, organic compounds, ions, polymers (proteins, nucleic acids, polysaccharides), supramolecular structures; organelles, membranes and walls; unicellular and multicellular organisms, cell division, mitosis; cell differentiation and specialisation; diversity and unity of cell structure, prokaryotes and eukaryotes; tissues and organs; major metabolic pathways, primary and secondary metabolism; enzymes; photosynthesis and photorespiration, chloroplasts, respiration, glycolysis, fermentation;
- inheritance: protein synthesis and gene expression; brief description of DNA, RNA, the double helix, recombination and mutation; Mendelian genetics;
- plant structure and function: roots, stems, leaves, meristems, flowers and seeds; plant cells and tissues, anatomical diversity; transpiration and translocation; nutrient uptake; primary and secondary growth;
- animal structure and function: tissues, organs and organ systems; comparative anatomy; homeostasis; nutrient uptake, circulation, gas and fluid exchange; structure of selected invertebrate groups, especially insects; mammalian structures; differences between animal and plant anatomy;
- reproduction and nutrition: heterotrophy and autotrophy; nutrients and nutrient cycling; productivity; gametogenesis - process and structures in plants and animals; fertilisation, seed development, germination, emer-

gence; gestation, embryo development, parturition, hatching; life cycles; animal growth (briefly);

- introduction to biodiversity and evolution: populations, communities and ecosystems; adaptation; phylogeny and evolution (brief introduction only);
- practicals: will emphasise the handling and identification of biological material and the use of microscopes and other instruments.

Assessment: Mid-semester examination (10%), final examination (70%), practicals (20%). Pass in practical component required.

Recommended texts: R B Knox, P Y Ladiges B K Evans and R Saint, *Biology*, McGraw Hill, 2001. or N Campbell and J Reece, *Biology*, Benjamin Cummings, 2002.

208-109 Australian Agriculture

Availability: Parkville campus

Credit points: 12.5

Coordinator: Assoc Prof Bill Malcolm

Contact: Thirty-six hours of lectures and 36 hours of demonstration and practical work, including full-day tours (*Semester 1*).

Description: The aim of this subject is to provide students with a range of knowledge, practical experiences and observations of the main agricultural industries land users of south-eastern Australia. It is expected that on the completion of this subject students should have gained a practical understanding of the management operations and options of the production cycle and be conversant with the limitations, constraints and impacts which influence them. Importantly, an insight into the landholder perspective of these industries will be gained. The place of agriculture in rural communities and factors affecting sustainability will be explored.

Topics covered include:

- the history and development of Australian agriculture;
- the annual cycle of production of the major agricultural industries in south-eastern Australia;
- the sustainability of these industries from economic, social, environmental and system-wide perspectives.

Assessment: A 3-hour written examination (60%), a one-hour test (10%), and two assignments each equivalent to 1000 words (15% each).

650-141 Biology of Cells and Organisms

See full subject details on page 1.

202-104 Information Technology and Communication

Availability: Parkville campus

Credit points: 12.5

Coordinator: Mr Nick Bailey

Contact: Thirty-six hours lectures, 36 hours practicals/tutorials (*Semester 1*).

Description: This subject will engage students in a high level of interactive learning, often using group collaborative learning tasks.

On completion of this subject, students should:

- have a working knowledge of, and basic competence in the use of, tools for communication and for accessing and managing information, particularly electronic and web-based technologies;
- understand the principles of effective communication at different levels (one-on-one, small group, large group etc.) and to audiences from different backgrounds and with different interests;
- have experience in written and oral communication to a range of audiences and be competent in both forms of communication, and also have experience in inter- and intra-team communication using electronic and web-based communication tools;
- have developed problem-solving and critical thinking skills to a level that will serve as a platform for further development of these capabilities throughout the course;
- understand group dynamics, and the factors that lead to effective team work.

Assessment: Referenced abstract (20%), oral presentation (20%), three software projects (15% each), assessed team processes (15%)

202-107 Mathematics for Land and Food Resources

Note: Students with a score of 25 or above in VCE Mathematics Methods or equivalent will not normally be permitted to enrol in this subject for credit.

Availability: Parkville campus

Credit points: 12.5

Coordinator: Mr John Pilkington & Ms Karen Baker

Prerequisites: Mathematics as a final-year subject at school or 202-250 Quantitative Skills for Land and Food Resources or equivalent.

Contact: Thirty-six hours of lectures, 36 hours of tutorials/workshops (*Semester 1*).

Description: Students should develop:

- mathematical knowledge and skills which are applicable to and provide a foundation for other Land and Food Resources subjects, including chemistry, biology, statistics and economics; and
- the ability to apply mathematical knowledge and skills to analyse, investigate, model and solve problems in a variety of situations, ranging from well-defined and familiar situations to unfamiliar and open-ended situations.

Course content will be set within the context of relevant examples. Technology will be used as an effective support for mathematical activity.

Topic areas include:

- Algebra: polynomials of up to and including degree 3, linear factors, factor theorem, remainder theorem, quadratic and cubic equations, transposition of formulae;
- Functions: trigonometric, exponential and logarithmic functions and graphs, including transformations; composite and inverse functions; solution of equations involving transcendental functions;
- Calculus: derivatives, product, quotient and chain rules for differentiation; integration of simple functions; applications of differentiation and integration including rates of change, related rates and simple differential equations;
- Sequences and series and applications;
- Probability and statistics: elementary probability; random variables, mean and variance; binomial and normal distributions; introductory statistical modelling, inference for population means, linear regression.

Assessment: One 3-hour examination, up to 24 pages of written assignments throughout semester and up to 1.5 hours of tests throughout semester.

Prescribed texts: S Tan, *College Mathematics, 5th ed*, Brooks/Cole 2002.

202-106 Land Resources

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Tony Weatherley

Contact: Thirty-six hours lectures, 36 hours practicals (*Semester 2*).

Description: This subject will focus on the nature of land resources and the processes of landscape evolution. Topics will include introductions to Australian geology, soils, climate and weather, ecosystems, water resources, catchment management and human impacts on the environment. It will demonstrate how science can be applied to evaluating and managing ecosystems, and to maintaining and improving the productivity of land resource-based industries.

On completion of this subject, students should be able to apply the principles developed in relation to major land systems in Australia and globally. They should also understand the application of various important practices in the management of land resources at different scales, and the adverse impacts of mismanagement of such systems.

Assessment: Three-hour examination (50%), one major assignment (small groups with individual responsibilities for members) of 3000 words (25%) and minor assignments equivalent in total to 3000 words (25%) based upon field, laboratory and problem based learning exercises.

207-101 Land, Food and Resource Economics

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Brian Davidson

Contact: Thirty-six hours lectures, 36 hours tutorials (*Semester 2, repeat Summer*).

Description: Students of agriculture, forestry, viticulture and horticulture require an understanding of the fundamental economic forces that effect markets for both the inputs and outputs in the system in which they operate. In particular, students need to be made aware that the management of the land and water resources has economic consequences. This is evident when such issues as salinity (an externality) and land degradation arise. Further, the links between the wider economic forces and the success of ventures in resource industries are indisputable. Recently commodity markets have been examined as part of the regularly occurring rounds of international trading agreements. The changes that have occurred in response to these agreements made under the World Trade Organisation, for both the domestic and international economies, have been far reaching for all participants in the markets. The information provided in this subject would ensure that students understand and can apply the economic concepts of supply and demand to issues of policy and trade analysis and of resource use.

Assessment: A 3-hour examination (60%), and a combination of assignments and class tests, equivalent to 2000 words (40%).

Prescribed texts: J Gans, S King and Mankiw, *Principles of Microeconomics*, 2nd ed. Harcourt Brace, 2004.

650-142 Genetics & The Evolution of Life

See full subject details on page 1.

Second-year subjects

202-201 Plant Function

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Marc Nicolas

Prerequisites: 202-101 Chemistry for Land and Food Resources or 610-141 Chemistry; 202-103 Biology for Land and Food Resources or 650-141 Biology of Cells and Organisms.

Corequisites: 202-202 Experimental Design/Statistical Methods

Contact: Twenty-four hours lectures, 36 hours practicals/tutorials (*Semester 1*).

Description: Plant Function is a functional approach to the question 'How do plants work?' and is delivered with an integrative, production-oriented approach. It is organised around three themes:

- biomass acquisition;
- biomass allocation; and
- environmental physiology: limitations to productivity.

Common content will include:

- radiation, energy budgets and transfer, photosynthesis, photorespiration;
- water use, uptake and transpiration, xylem flow, stomatal control;
- biomass assimilation, translocation and storage, respiration, phloem;
- root growth and function, nutrients and nutrient uptake, nitrogen fixation;
- plant vegetative development, production of flowers and fruit, seed dormancy and germination; and
- abiotic factors affecting growth and productivity (deficiency or excess): light, temperature, nutrients, water, biotic factors affecting growth and productivity, secondary metabolism.

It will be augmented by stream-specific content, including:

- crops (leaf area development, canopy light interception, dry matter partitioning);
- horticulture (plant selection, environmental modification, plant hormones);
- forestry (lignin, water relations of trees, nutrient deficiencies in pines and eucalypts); and
- animals (inherent qualities of plants as food and feed, changes from manipulation).

Practicals will cover topics in plant physiology, give skills in basic plant handling, field and greenhouse experimentation, and measurement and statistical analysis of populations of plants.

Assessment: A three-hour exam (50%) and two assignments equivalent to 3000 words (each worth 25%).

202-202 Experimental Design/Statistical Methods

Availability: Parkville campus

Credit points: 12.5

Coordinator: Mr Barry Harridge

Prerequisites: 620-081 Preliminary Mathematics A or 202-107 Mathematics for Land and Food Resources or VCE Mathematics Methods or equivalent.

Contact: Thirty-six hours lectures; 24 hours tutorials/practicals (*Semester 1*).

Description: Upon completion of the subject, students should be able to:

- understand and apply the basic concepts of study design, such as observational studies versus designed experiments, replication, randomisation, blocking and confounding, and recognise the effect of the design concepts on the interpretation of results;
- recognise and apply experimental designs such as completely randomised, randomised block and Latin square designs;
- construct and interpret appropriate graphs and tables for displaying and summarising data;
- understand the basic concepts of statistical models such as estimation, predicted values, residuals, parameters and the normal distribution;
- formulate, fit and interpret models involving one or two explanatory variables, which may be categorical, numerical, or one of each;
- state the assumptions of simple models and use the data and residuals to check these assumptions;

- understand the purposes and limitations of statistical inference, and use the main tools of inference, including measures of precision, confidence intervals, P-values, hypothesis tests and significance; and
- use the statistical package Minitab to explore and analyse data, and interpret the output in terms of the original context of the data.

Topics include:

- types of variables; observational studies and designed experiments; replication, randomisation and blocking; displaying and summarising data;
- statistical models - formulation, estimation, checking and inference; comparing and selecting models; analysis of variance; linear regression;
- standard errors, confidence intervals and hypothesis tests; experimental designs - randomised blocks, Latin squares, incomplete blocks; ANOVA with two factors; interaction; and
- residual plots; transformations; multiple regression; combining categorical and numerical explanatory variables; contingency tables.

Assessment: A three-hour final examination (65%), a mid-semester test (15%) and assignments totalling (20%).

202-203 Soil and Water Resources

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Robert Edis

Prerequisites: 202-101 Chemistry for Land and Food Resources.

Contact: Twenty-four hours lectures, 36 hours practicals (*Semester 2*).

Description: This subject will identify the importance of soil and water in the landscape and as key components of ecosystems, both natural ecosystems and production systems. A basic knowledge of soil properties and behaviour will be applied to understanding the cycling of water and nutrients, the appropriate use of fertilisers, irrigation and drainage, and soil management practices designed to maintain soil and water resources in good condition. The origin of soil variation in the landscape and codification of soil information through classification will be introduced.

The subject will cover areas including:

- the origins of soil variability and how this variability is expressed through the properties and behaviour of soils in the field (builds on the 100-level subject Land Resources);
- soil profile description; an introduction to soil classification (the Australian Soil Classification);
- the physical and chemical nature of soil minerals and organic matter; the main soil organisms and their function; reactions in the soil solution and between the solution and surfaces;
- soil structure, aeration, water retention and movement, availability of water to plants and effects of waterlogging;
- introduction to nutrient cycling and its importance in natural ecosystems and production systems (agriculture, horticulture and forestry); emphasis on N, P, K and S; use of fertilisers and other soil amendments to correct nutritional problems;
- the hydrological cycle, with emphasis on the major processes - precipitation, evaporation, runoff and drainage; catchment processes and water management at the farm scale, including irrigation. Examples of water balances at large (basin) and small (farm) scales;
- land degradation processes and their management - accelerated soil acidification, sodicity, salinity and erosion; understanding the processes and the extent of the problems; remedial measures; and
- the impact of soil management on water quality, especially with respect to nutrients and salts.

Assessment: Three-hour examination (50%) and two assignments equivalent to 3000 words (each worth 25%).

Recommended texts: R E White, *Principles and Practice of Soil Science*, 3rd edn, Blackwell Science, 1997.

208-210 Agricultural Management Economics

Availability: Parkville campus

Credit points: 12.5

Coordinator: Assoc Prof Bill Malcolm

Prerequisites: 207-101 Land, Food and Resource Economics or 316-102 Introductory Microeconomics.

Contact: Twenty-four hours lectures, 36 hours practicals (*Semester 2*).

Description: The aim of this subject is for students of agricultural science and agricultural economics to understand the principles of management economics applied to the operation of agricultural business, be able to analyse investment and profitability of resource use in agricultural businesses, and evaluate business marketing strategies.

The content of the subject is as follows:

- management;

- financial management;
- profit, cash flows and business structure;
- activity analysis;
- budgeting;
- investment analysis;
- risk management; and
- futures markets.

A number of case studies will be completed.

Assessment: A 3-hour examination (60%) and two 2000-word assignments (20% each). Students must achieve a minimum of 45% in the examination in order to pass the subject.

Recommended texts: L R Malcolm and J P Makeham, *The Farming Game Now*, CUP, 1992.

208-247 Biotechnology for Land and Food

Credit points: 12.5

Coordinator: Assoc Prof Mohan Singh

Prerequisites: 202-103 Biology for Land and Food Resources or 650-141 Biology of Cells and Organisms

Contact: Twenty-four lectures and 36 hours of other activities (group discussions; computer based activities for searching biotechnology related databases, preparing social and environmental impact reports) (*Semester 2*).

Description: By the end of the subject students should have

- Acquired knowledge of the basic principles of genetics, molecular biology and genome science that underpin the new developments in biotechnology.
- Developed an understanding of local and global issues in biotechnology in relation to environmental health and sustainable crop and animal production.
- Understanding of processes involved in commercialization of biotechnology related products and services.
- Gained ability to synthesize, interpret and discuss current scientific literature.

This subject will introduce students to scientific concepts and knowledge underpinning biotechnology and will enable acquisition of knowledge and skills relevant to practice of biotechnology in food, cropping, dairy and horticulture industries. The subject will also include discussion of contemporary social and economic issues arising due to adoption of biotechnology. Topics to be covered include introduction to biotechnology and underpinning methodologies; applications of biotechnology in diagnostics, transgenic microbes, plants and animals; crop protection; nutritional value enhancement of food products; diagnostic technologies; microbial biotechnology; environmental impact analyses; animal biotechnology; stem cells and reproductive technologies; intellectual property protection and management; social issues and public perceptions of biotechnology; commercialization of research; regulatory issues; international trade and related economic issues.

Assessment: Two hour end-of-semester written examination (50%); one-hour mid semester test (25%); Exercises and practical work submitted during the term equivalent to 3000 words (25%).

Third-year subjects

202-302 Human Resource Management

Availability: Parkville campus

Credit points: 12.5

Coordinator: Ms Ros Gall

Contact: Twenty-four hours lectures and 24 hours practicals/discussion group participation (*Semester 1*).

Description: This subject introduces management theories and their application including functions of management, leadership, power, authority, social responsibility of organisations, organisational structure, conflict resolution and change management. In particular the strategic and operational role of human resource management, human resource planning, job analysis and design, recruitment, remuneration, appraisal, development and training will be explored. This will be complemented by an overview of the Industrial Relations Framework.

Topics include: management theories and philosophies; functions of management and leadership; power and authority in organizations; organising the workplace (organisational structures and job design); the strategic and operational role of human resource management: human resource planning, job analysis and design, recruitment and selection, staff remuneration, performance appraisal, development and training; improving organisational effectiveness; change management; groups and teams; motivation and job satisfaction; conflict management; social responsibility of organisations; overview of the Australian Industrial relations framework.

Assessment: A 3 hour end-of-semester examination (50%) and assessment of tutorial worksheets (50%, equivalent to maximum of 5000 words).

Recommended texts: S Robbins, R Bergman, I Stagg and M Coulter, *Management*, 3rd edition, Prentice Hall, Sydney, 2003.

Year-long subjects

202-001 Industry Placement#

Note: This subject is a hurdle requirement for completion of the Bachelor of Agricultural Science, Bachelor of Agriculture, Bachelor of Animal Science and Management, Bachelor of Food Science, Bachelor of Forest Science, Bachelor of Horticulture, Bachelor of Resource Management, Bachelor of Rural Business and the combined degrees.

Availability: Parkville campus

Coordinator: Mr Rowan Reid

Contact: At least 12 weeks practical experience in an industry workplace (16 weeks for BFor or BForSc students), arranged by the student in consultation with the campus coordinator. This must include two placements of at least four weeks duration, unless a variation is negotiated. Students may also be required to complete formal training in workplace occupational health and safety, risk assessment, and practical skills acquisition, delivered in block courses (*Year long*).

Description: Work experience is a feature of all ILFR degree and advanced diploma courses. On completion of Industry Placement, students should have:

- direct experience of employment and of employer-employee relationships in a range of workplaces in the relevant land and food industries;
- improved inter-personal and vocational skills;
- broader understanding of the diversity of workplaces and professional roles in the relevant land and food industries;
- greater appreciation of the practical application of the content taught during their course; and
- improved practical skills relevant to the management and operation of businesses in the land and food industries.

Industry placements may be undertaken in a range of businesses in the relevant land and food industries. These include commercial farm, horticulture, animal management or forest operations, service industries including financial institutions, government departments and agencies, research and development organisations, processing and marketing companies. Students are responsible for organising their own placement, but will be assisted if requested and will be assigned a supervisor for the subject. Formal training in workplace occupational health and safety, risk assessment, and practical skills may be provided in block courses to give students an appreciation of safe working practices.

Assessment: A written report (1000 words) is submitted on one period of industry placement and is marked as pass/fail only. A journal must be kept for all placements and be made available for review by the campus coordinator. Host employers will complete evaluation forms assessing the standards of performance and participation achieved by students while on placement.

202-301 Industry Project

Availability: Parkville campus

Credit points: 25

Coordinator: Mr Rowan Reid

Prerequisites: Completion of 1st and 2nd year of degree, or equivalent.

Contact: Twelve hours of lectures, plus class contact and seminars as arranged (*Year long*).

Description: This subject involves definition and development of an industry-related project, and develops skills in project management, problem solving and planning and reporting investigations. The topic involves or draws on a specific and defined industry issue, and may be developed in relation to a period of time spent in industry placement or to previously or concurrently selected elective subjects, applying the knowledge gained in these subjects to a real resource-based industry investigative problem. The project may relate to an applied scientific, economic or sociological or managerial topic, and the work will involve close collaboration between student, academic and industry advisors.

Students work interactively with campus coordinators and the class to define their particular project. Each student prepares a project proposal that includes methodology and approach, and covers the relevant background. Each student will subsequently prepare a detailed literature review, to place their project in context with the industry Project execution. This involves establishing base knowledge in the relevant area; definition of the issue; analysis of the approaches normally taken by industry to address such problems and the degree of success normally attained. A final report is submitted by each student and an oral presentation is presented at completion to an audience including industry members. These detail development of suitable investiga-

tive strategies and methodologies and the analysis of results or outcomes in a practical context.

Students meet regularly as a group or electronically for guided, interactive discussion on their projects. Students are required to attend a series of seminars delivered on project design, management and communication strategies, including case studies.

Assessment: Project proposal (1000 words, 15%), Literature review 3000 words, (15%), Final written report 5,000-10,000 words (50%), Oral presentation (20%).

202-303 Industry Project

Availability: Parkville campus

Credit points: 25

Coordinator: Mr Rowan Reid

Prerequisites: Completion of 1st and 2nd year of degree, or equivalent.

Contact: As for 202-301 Industry Project (*Semester 1, repeat 2*).

Description: As for 202-301 Industry Project.

Assessment: As for 202-301 Industry Project.

Fourth-year subjects (honours)

208-411 Research Philosophies and Statistics

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Dennis O'Brien

Prerequisites: Eligibility for honours or postgraduate degree; 202-202 Experimental Design and Statistical Analysis or equivalent

Contact: 24 hours lectures, 24 hours tutorials (*Semester 1*).

Description: This subject should give students knowledge of a range of research methodologies and underlying philosophies, and sophisticated statistical tools to design laboratory and field experiments and field surveys, and effectively and appropriately analyse these data sets in agriculture, horticulture and land management.

Upon completion of the subject, students should be able to:

- formulate research questions and hypotheses, and implement hypotheses testing, to satisfy research needs in different disciplines, including field research and economics;
- recognise, understand and apply concepts of study design (such as observational studies versus designed experiments, confounding, replication, randomisation, and blocking), and discuss the effect of design concepts on the interpretation of results;
- determine the appropriate statistical methodology to use, including parametric and non-parametric methods, and confirm that data sets meet the underlying assumptions of the statistical model chosen;
- display an understanding of the purpose and limitation of inference, and be able to use the main tools of inference to analyse and interpret data;
- interpret statistical programme outputs in agricultural, horticultural and land management contexts

Assessment: A 3-hour examination (50%), one assignment of up to 3000 words or equivalent (50%).

Prescribed texts: Zar, J H, *Biostatistical Analysis*, 4th ed. 1999.

202-404 Emerging Issues in Land Resources

Availability: Parkville campus

Credit points: 12.5

Coordinator: Prof Snow Barlow

Prerequisites: Eligibility for honours or postgraduate degree.

Contact: 24 hours seminars and forum debates, 12 hours tutorials (*Semester 2*).

Description: This subject provides insight into the emerging issues faced by the various land management disciplines, particularly in Australia. These may include social, economic and biophysical aspects of issues such as genetically modified organisms, climate change, globalisation and market protection, access to water, changing consumer demands, spatial information technologies, land and water degradation and loss of biodiversity. Experts in various fields of agriculture, biology, resource management, public policy, climatology and commerce will deliver reviews of emerging issues, and assess potential impacts on agriculture, the environment, rural and urban communities and the rural and national economy in a series of facilitated forums. Approaches for collecting and analysing information that has not been peer reviewed will be examined.

On completion of this subject, students should be able to:

- communicate the major emerging issues impacting on Australian land management disciplines;

- evaluate the impact of emerging issues on individual industries;
- evaluate technological and policy needs for mitigating impacts and realising opportunities resulting from emerging issues; and
- identify new issues as they arise and be able to analyse their potential impact.

Assessment: One assignment of 5000 words (50% of total marks), three forum critiques up to 1000 words each (30% of total marks), individual seminar presentation (20%). Students are also required to demonstrate attendance at the ILFR seminar program.

Year-long subjects

202-401 Honours Research Project

Availability: Parkville campus

Credit points: 50

Coordinator: Prof Roger Cousens

Prerequisites: Eligibility for honours degree.

Contact: Twelve hours of lectures, plus supervisor contact and seminars as arranged (*Year long*).

Description: This industry-based research honours project develops a student's ability to design and undertake a substantial body of work, to find solutions to a particular industry or discipline issue, and to report on this in written and verbal form. The project topic is developed in close collaboration between student, academic and industry advisers. Project definition is completed two weeks after commencement of the semester of enrolment in the subject, and requires approval from the subject coordinator based on input from academic and industry advisers, taking into account the student's preparation through previous selection of elective or stream subjects.

Students registered in the subject will attend a series of lectures delivered throughout the institute on research methodology, statistics and data analysis. Logistic assistance for projects is coordinated on a case-by-case basis.

Each student prepares a short oral presentation on their project proposal, which is peer-reviewed, as well as a written proposal (5-8 pages) to be assessed by academic and industry advisers. A more detailed oral presentation is presented on the final results of the project to an audience of Faculty and industry staff.

Assessment: Written project proposal (10%), thesis of 10 000-15 000 words (75%), final oral presentation (15%).

202-402 Honours Research Project

Credit points: 50

Coordinator: Prof Roger Cousens

Prerequisites: Eligibility for honours degree.

Contact: As for 202-401 Honours Research Project (*Semester 1, repeat 2*).

Description: As for 202-401 Honours Research Project.

Assessment: As for 202-401 Honours Research Project.

202-403 Honours Research Project (MYE)

Credit points: 50

Coordinator: Prof Roger Cousens

Prerequisites: As for 202-401 Honours Research Project

Contact: As for 202-401 Honours Research Project (*Semester 1, repeat 2*).

Description: As for 202-401 Honours Research Project.

Assessment: As for 202-401 Honours Research Project.

Elective subjects

Note: Insufficient enrolments may lead to a subject being suspended.

First-year electives

207-103 Ecology

See full subject details on page 1.

208-101 Farm Animal Biology

Availability: Parkville campus

Credit points: 12.5

Coordinator: Mr Chris Laird and Dr Brian Leury

Prerequisites: 202-103 Biology for Land and Food Resources.

Contact: Thirty-six hours lectures, 36 hours of practicals (*Semester 2*).

Description: On completion of this subject students should:

- understand the basic anatomy of the major domestic and agricultural animal species and the principal functions of the major organs and tissues;

- understand how and what products are harvested from farm animals and how manipulating animal form and function can alter animal production;
- understand animal behaviour, factors modifying its expression and the influence of behaviour on animal production as well as the implications for animal welfare;
- be able to analyse how the environment and genetics influence animal performance and the quality of products harvested; and
- appreciate the importance of animal health in animal production systems and that disease usually has animal management as a component of its occurrence, prevention and treatment.

Assessment: A three-hour written examination at the end of semester (70%), practical work (20%) and tutorial work (10%).

Recommended texts: W Bruce Currie, *Structure and Function of Domestic Animals*, CRC Press Inc., 1995.

208-107 Vineyard and Winery Operations I

Availability: Dookie campus

Credit points: 12.5

Coordinator: Mr Geoff Bath

Contact: Flexible delivery with a one-week residential school at Dookie Campus in the week prior to the commencement of Semester 2 that includes practical sessions in the campus vineyard, winery, laboratory and tasting rooms. Prior to the residential school, students receive a printed subject guide, subject notes (taking the place of face-to-face lectures) and a practical book. In the subject guide, students receive a planner outlining the work that must be completed on a weekly basis throughout the semester. Two assignments are completed at different times during semester, one related to viticulture and one to oenology (*Semester 2*).

Description: The subject Vineyard and Winery Operations for Quality Wine Production I is the first of two units that provide students with the basic knowledge of management strategies to maximise the quality and yield of grapevines along with a basic knowledge of the principles and practices of wine production.

On completion of the viticulture component of the subject students should be able to:

- explain the commercial influences on vineyard establishment and operation;
- describe major weather differences;
- evaluate the suitability of different cultivars for different purposes and locations; and
- demonstrate the skills and knowledge associated with a number of winter and spring vineyard operations.

Oenology components of the subject are:

- the characteristics of white and red wine cultivars;
- principles and practices involved in production of various wine styles;
- post-fermentation treatments associated with wine production; and
- evaluation of wine styles and flavour characteristics using basic sensory processes.

Assessment: Examination (3-hour 40%), two assignments (each 2000 words and 20%), practical reports (20%).

610-142 Chemistry B

See full subject details on page 2.

Second-year electives

207-201 Resource Management Economics

See full subject details on page 2.

208-201 Comparative Nutrition

Note: This subject involves the use of animals in experiments. Students should be aware that these experiments are an essential part of the course and exemption from this component is not possible.

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Julian Hill

Prerequisites: 202-101 Chemistry for Land and Food Resources or 610-141 Chemistry; 202-103 Biology for Land and Food Resources or 650-141 Biology of Cells and Organisms.

Contact: Twenty-four hours lectures, 12 hours tutorials and 36 hours of practical work, with computer-aided learning enhancement (*Semester 2*).

Description: At the end of the subject the students should be able to:

- understand the physiological and metabolic basis of nutritional requirements;

- understand the nutritional qualities of particular classes of feedstuffs;
- understand the principles of feed evaluation and ration formulation;
- be familiar with principles and practices in diagnosis of nutritional inadequacies and nutrition-related diseases;
- be familiar with commonly used computer-based nutritional models;
- have used simulation models in solving nutritional problems;
- be able to formulate rations for particular classes of animal; and
- be able to formulate supplements for animals under specified nutritional circumstances.

An understanding of basic nutrition is a prerequisite for subsequent courses in the animal sciences stream and enables the student to appreciate (a) the significance to animal production of many other subjects in the course and (b) the nutritional quality criteria in production and processing of human foods and animal feeds.

Content includes:

- nutrition and energy metabolism basic nutritional and bioenergetic concepts;
- the nutrients, their chemical and physical properties, digestion, metabolism, and metabolic roles and interactions; their supply and availability in feedstuffs;
- nutritional requirements of animals;
- the central role in animal production of efficiency of conversion of feeds to desired products;
- food resources: identification and utilisation in meeting nutritional needs of domestic animals and humans; and
- basic ration formulation and problem solving in nutrition.

Assessment: Three-hour examination (40%) and three practical assignments equivalent to 2500 words (each worth 20%).

Prescribed texts: McDonald, Edwards, Greenhalgh and Morgan, *Animal Nutrition, 5th edition*, Longman Scientific, Harlow.

208-202 Animal Physiology

Note: This subject involves the use of animals in experiments. Students should be aware that these experiments are an essential part of the course and exemption from this component is not possible.

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Brian Leury

Prerequisites: 202-103 Biology for Land and Food Resources or 650-141 Biology of Cells and Organisms.

Contact: Twenty-four hours lectures, 36 hours practicals (*Semester 1*).

Description: On completion of the program should have:

- the working knowledge of structure and normal physiological function of domestic animals;
- the terminology and basic principles of structure and function in animals;
- functions of different cell types and their interactions in organs and tissues;
- mechanisms by which organ systems are controlled and functions coordinated;
- the physiology of the nervous system, of digestion, circulation, respiration, and excretion;
- the processes of growth, reproduction and lactation; and
- differences in animal performance relating to physiological factors.

The content of the subject includes:

- cell physiology, molecules and membranes;
- nervous system and information transfer;
- muscle function;
- lymphocytes and the immune system;
- physiology of cardiovascular, gastro-intestinal, renal, respiratory and reproductive systems;
- endocrine system; and
- lactation; growth and development.

Assessment: Three-hour examination (70%), practical and tutorial work submitted during the semester, equivalent to 3000 words (30%).

Prescribed texts: Sherwood, Klandorf and Yancey, *Animal Physiology from Genes to Organisms*, 1st edn 2005.

208-203 Ecology & Management of Grazing Systems

Availability: Parkville campus

Credit points: 12.5

Coordinator: Prof David Chapman

Corequisites: 202-201 Plant Function.

Contact: Twenty-four hours lectures, 36 hours practicals/tutorial sessions (*Semester 1*).

Description: On completion of this subject, students should:

- understand the basic ecology and agronomy of pasture communities and the factors that influence yield of a grazed pasture;
- know the principles underlying efficient pasture and grazing management, and the practices required for sustainable production from grazing systems;
- appreciate the importance of seasonality in pasture production, and its consequences for the management of grazing systems;
- have experience in using the practical tools and skills required for the efficient management of grazing systems; and
- be able to solve problems in the management of grazing systems.

The subject will include:

- analysis of Australia's pasture and grassland resources;
- pasture plant form and function, including basic plant growth processes;
- the population biology of pasture plants, including the growth cycles of annual and perennial plants, and pathways of plant survival;
- the major pasture plant species and pasture types, their agronomic and adaptive characteristics and management requirements;
- interactions between plants and their environment, and between plants and animals and their effects on the productivity and botanical composition of pastures;
- the feeding and nutritive value of pastures and factors affecting animal intake;
- pasture improvement principles and practices;
- matching feed supply and demand for efficient animal production including the use of feed planning tools;
- the principles and practices of grazing management; and
- optimising pasture production and utilization in seasonal production systems.

Assessment: Three-hour examination (50%), three assignments completed using interactive multimedia (totalling 40%), and practical assignments (totalling 10%).

208-205 Australia in the Wine World

Availability: Parkville campus

Credit points: 12.5

Coordinator: Prof Snow Barlow

Contact: One-week block in February. Students are required to undertake some reading prior to attending the block and complete a major assignment following the block. Prior to the one-week block, students receive a printed subject guide, subject notes, a reader and a practical book. The examination is held on the last afternoon of the one-week block, and the assignment is due three weeks after the one-week block (*Semester 2, repeat Summer*).

Description: The objective of this subject is to introduce students to the Australian wine industry and its role in world wine production.

The content includes:

- evolution of the grapevine;
- history of viticulture and winemaking;
- main grape varieties of the world and their distribution;
- chemistry of winemaking;
- wine tasting;
- appellation and the culture of wine;
- world wine regions including France and Germany, Spain Portugal and Italy, North America, South America, South Africa, New Zealand and Australia;
- Australian wine regions and production;
- the global wine trade and Australia's export markets; and
- wine, food, health and culture.

Assessment: Examination (3-hour, 40%), assignment (4000 words, 40%), practical reports (20%).

208-206 Vineyard and Winery Operations II

Availability: Dookie campus

Credit points: 12.5

Coordinator: Mr Geoff Bath

Contact: Subject is offered by flexible delivery. Prior to the residential school, students receive a printed subject guide, subject notes (these take the place of face-to-face lectures) and a practical book. Students attend a one-week residential school at Dookie Campus in the week prior to the commencement of Semester 1. Practical sessions in the campus vineyard, winery, laboratory and tasting rooms are undertaken during the residential school. In the subject

guide, students receive a planner outlining the work that must be completed on a weekly basis throughout the semester (*Semester 1*).

Description: The subject Vineyard and Winery Operations for Quality Wine Production II is the second of two units that provides students with the basic knowledge and skills to prepare management strategies to maximise the quality and yield of grapevines along with a basic knowledge of the principles and practices of wine production.

The subject introduces students to grape handling and fermentation. Evaluation of wine, styles and flavour characteristics are refined using basic sensory processes.

On completion of the subject students should be able to:

- demonstrate the skills and knowledge associated with a number of summer and autumn vineyard operations; and
- propose management options for improving grape quality.

Assessment: Examination (3-hour, 40%), assignments (2 x 2000 words, 40%), practicals (20%). Two assignments are to be completed during the semester, one on viticulture, one on oenology, due at different times in the semester and returned to students prior to the final examination.

208-207 Animal Management and Production

Note: This subject involves the use of animals. Students should be aware that this is an essential part of the subject and exemption from this component is not possible.

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Sarah Chaplin

Semester: Semester 2

Description: On completion of this subject, students should be:

- aware of all the major inputs into an animal production system;
- aware of the products of animal production systems and product quality;
- able to understand the effects of changes in inputs and/or outputs on the efficiency of the production system;
- capable of the basic analysis of a production system;
- aware of alternative production systems; and
- capable of surveying an animal industry.

The course provides a review of the major animal production industries of Australia and includes a basic introduction to the following key issues in livestock production systems:

- the size, distribution and value of each animal industry;
- breed selection and genetic improvement;
- practical feeding of breeding and growing animals;
- optimisation of reproductive output;
- environmental effects and use of buildings;
- management regimes to maintain animal health;
- maximisation of product quality;
- production system analysis and consideration of alternatives; and
- marketing and markets.

Assessment: One three-hour exam (50%) and two assignments equivalent to 3000 words (each worth 25%).

208-208 Crop Production

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Rob Norton

Semester: Semester 2

Description: This subject includes:

- an appraisal of the cropping enterprises in southern Australia - the location, scale and nature of cropping enterprises and their contribution to the national economy;
- growth, development and yield in crop production - definitions and relations between growth and development attributes, yield and yield components, measurement of crop yields, biological and economical yield and harvest index (complemented by field exercises);
- environmental constraints limiting productivity - climate and growing season, water and nutrient availability;
- agronomic management to optimise production and product quality, including water and nutrient management, soil management and rotations;
- nutrient cycling; and
- problems and prospects of both dryland and irrigated crop production within farm systems, comparative cost-return analysis, marketing strategies.

Assessment: Three-hour examination (50%), a practical test (10%) and two assignments equivalent to 2500 words (each worth 20%).

451-312 GIS & Remote Sensing for Enviro Science

See full subject details on page 7.

521-211 Biochemistry & Molecular Biology Part A

See full subject details on page 1.

521-212 Biochemistry & Molecular Biology Part B

See full subject details on page 2.

526-201 Principles of Microbiology & Immunology

See full subject details on page 1.

Third-year electives

202-304 Agricultural Systems Analysis

Availability: Parkville campus

Credit points: 12.5

Coordinator: Prof David Chapman

Contact: Twenty-four hours of lectures/tutorials, and up to 36 hours practical work (*Semester 2*).

Description: On completion of this subject, students should have gained:

- a basic understanding of systems theory and practice;
- experience in practical situation analysis and skills in problem solving, in 'real world' settings;
- recognition of the importance of adult learning and decision-making processes in the management of agricultural businesses and natural resources;
- an understanding of the way technology is adopted in the management of agricultural businesses and natural resources; and
- the opportunity to apply knowledge gained earlier in their course to the solution of practical problems.

Students will carry out six case study analyses during the semester. Each case study addresses an aspect of systems analysis and management, and is based on a commercial farm or resource management business. Case study analysis will require students to clearly identify the problem to be solved and the context for problem solving (including business and personal goals of the owners and their approach to management and decision making), analyse options for solving the problems and meeting goals, and communicate their findings to the 'client'. Case study visits are supplemented by lectures and tutorials that develop the theory and practice of systems analysis and thinking. The subject integrates traditional biophysical science disciplines, economics, and human systems elements. It is designed to enable students to work effectively with the owners and managers of resource management and agricultural businesses in bringing about change in their business.

Assessment: Six case study reports, each of 1500-2000 words and worth 15-20% of total marks.

207-301 Global Environment and Sustainability

See full subject details on page 3.

207-328 Working with Community Groups

Availability: Dookie campus

Credit points: 12.5

Coordinator: Ms Cathy Botta

Contact: Thirty-five-hour workshop conducted over five consecutive days (*Semester 1*).

Description: The objective of this subject is to introduce the students to the roles, understanding and skills of extension workers, through practice, observation and reflection.

The content includes:

- exploration of the roles of extension workers in a range of occupations, including some background on the philosophy and practice of extension;
- methods extension workers use to engage rural people in individual and cooperative learning projects;
- practice in group skills and other skills used by extension workers;
- an insight into the workings of rural communities; and
- introduction to the literature of extension and rural sociology.

Assessment: Participation, students are assessed on an individual basis (20%), reflective statement (10%), literature review (40%) and presentation of case study (30%).

207-330 GIS and Remote Sensing

See full subject details on page 3.

208-301 Crop and Pasture Physiology**Availability:** Parkville campus**Credit points:** 12.5**Coordinator:** Dr Marc Nicolas**Prerequisites:** 202-201 Plant Function**Contact:** Twenty-four hours of lectures and 36 hours of practicals (*Semester 1*).**Description:** Students should develop an understanding of the productive processes that determine growth and yield in crop and pasture communities. They should also develop skills in critically analysing literature and in designing and conducting experiments.

On completion of this subject, students should be able to understand the interactions between plant canopies and the environment that determine yield and product quality; synthesise information from a range of disciplines including plant anatomy and physiology, biochemistry and engineering (environmental physics); critically analyse literature on physiological and agronomic topics; set up and conduct experiments to test hypotheses; and interpret experimental results and report their findings in seminars and written reports.

The main sections are phenological development; light interception, carbon economy; water use; responses to environmental stresses, including drought and salinity; nutrient economy; and pasture management.

Assessment: A 3-hour end-of-semester written examination and two written assignments of no more than 4000 words each.

208-302 Molecular Biology and Breeding**Availability:** Parkville campus**Credit points:** 12.5**Coordinator:** Dr P Bhalla & Dr P Salisbury**Prerequisites:** 202-103 Biology for Land and Food Resources and 202-101 Chemistry for Land and Food Resources. 650-142 Genetics and the Evolution of Life is desirable but not essential.**Contact:** Thirty hours of lectures, 30 hours of other activities (assignments, computer searches of gene and patent data bases, breeding case histories) (*Semester 1*).**Description:** On completion of this subject students should:

- understand the principles and methodology of crop and animal breeding, and the contribution of genes to development of quantitative traits; and
- have basic understanding of molecular biology, genetic engineering and its impact on agriculture (plant and animal), horticulture, forestry and the food industry.

Topics include nature of genes and regulation of gene expression at the molecular level; introduction to gene manipulation and recombinant technology for production of improved food and forest plants, crops and food animals; management of transgenic plants, crops and animals in agricultural systems; risks and concerns regarding environmental release of transgenic organisms, and safety criteria for transgenic food; principles and methodology of crop and animal breeding, basic population genetics and genetic development of quantitative traits; evolutionary processes and genetic variability of plant populations; world-wide distribution and conservation of plant genetic resources; methods of breeding self- and cross-pollinating plants, development of hybrids, chromosome manipulation and polyploidy; methods for breeding disease and insect resistance in agricultural plants; molecular markers for DNA fingerprinting, genetic diversity, marker-assisted selection; and special techniques in plant breeding, somatic hybridisation and tissue culture.

Assessment: Two-hour end-of-semester examination (50%), one-hour mid-semester test (25%), written project report (4000 words, 25%)

208-303 Animal Production Systems**Note:** This subject may involve the use of animals. Students should be aware that this is an essential part of the course and exemption from this component is not possible.**Availability:** Parkville campus**Credit points:** 12.5**Coordinator:** Prof David Chapman**Prerequisites:** 208-207 Animal Management and Production and 208-203 Ecology and Management of Grazing Systems.**Semester:** Semester 1**Description:** On completion of this subject, students should be able to:

- identify the factors that drive animal production, for a range of animal industries;
- analyse animal production systems in terms of their biological efficiency, and identify ways of improving their efficiency;
- apply scientific principles of growth, reproduction and breeding of animals to the design and management of livestock production systems; and

- apply skills in problem solving to practical situations.

This subject uses a problem-based learning approach to develop skills and knowledge in the design and management of efficient animal production systems. Generic content of the subject is covered in lectures and includes: applied animal nutrition, including cost-effective feeding practices for both intensive and extensive animal industries; reproductive management and its importance in determining animal and farm productivity; the role of genetics and its interaction with other components of the animal production system; effects of management inputs on animal product quality; and risk management strategies for sustainable livestock production. This knowledge is developed within the context of selected livestock industries by way of practical assignments which present real-life problems, opportunities or issues for students to address.

Assessment: Three-hour examination (50%), plus assignments submitted during semester and totalling 5000 words.

208-304 Advanced Topics in Animal Science**Note:** This subject involves the use of animals. Students should be aware this is an essential part of the subject and exemption from this component is not possible.**Availability:** Parkville campus**Credit points:** 12.5**Coordinator:** Dr Brian Leury**Prerequisites:** 208-202 Animal Physiology.**Semester:** Semester 2**Description:** At completion of this subject students should:

- be aware of the motivation for, and implications of, current animal research areas and the use of new technologies to improve or modify animal performance;
- have an advanced understanding of the molecular, physiological, metabolic and endocrine factors involved; and
- be aware of any social, economic or ethical considerations associated with the application of new technologies to improving or modifying animal performance.

This subject presents to students a range of topics covering new and innovative research related to the improvement in or modification of animal performance and product yield, composition and quality. Emphasis will be placed on keeping students abreast of new and emerging areas of animal science and biotechnology related to growth and development, red and white meat production, fibre production, lactation and milk production and reproduction. Lecture material will be supplemented with independent, self-paced learning through projects and assignments in specific areas of animal science chosen by the students.

Assessment: Three-hour examination (50%), one assignment equivalent to 3500 words (25%), one assignment equivalent to 2000 words (15%) and a seminar (10%).

208-306 Agricultural Marketing**Availability:** Parkville campus**Credit points:** 12.5**Coordinator:** Assoc Prof Bill Malcolm**Prerequisites:** 207-101 Land, Food and Resource Economics or 316-102 Introductory Microeconomics.**Contact:** Thirty-six hours of lectures and 36 hours of tutorials (*Semester 2*).**Description:** This subject is about marketing of agricultural products. The content deals with:

- marketing as a business activity;
- schools of marketing thought;
- perfect and imperfect competition in business activity;
- agricultural supply and supply chains;
- agricultural demand;
- price formation;
- analysis of effects of interventions in agricultural markets;
- determination and distribution of marketing margins;
- product differentiation;
- product grading;
- promotion;
- risk in marketing;
- strategic alliances;
- transactions costs;
- contract marketing;
- cooperative marketing;
- international trade in agricultural products; and

- issues in marketing the major agricultural products.

Assessment: A three-hour examination (60%), and two assignments equivalent to 3000 words (each worth 20%).

Prescribed texts: W G Tomek, and K L Robinson, *Agricultural Product Prices*, Cornell University Press, 1990.

208-307 Plant Pathology

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Paul Taylor

Contact: 24 hours of lectures and 36 hours of practical work (*Semester 1*).

Description: On completion of this subject, students should:

- be familiar with the biology and taxonomy of the major biotic causes of disease;
- understand the use of molecular biology techniques in plant pathology;
- be aware of the factors leading to disease epidemics;
- be capable of diagnosing common diseases of agricultural and horticultural crops; and
- be able to formulate a practicable approach to integrated control in commercial species.

Topics covered include:

- taxonomy, identification and biology of the main groups of plant pathogens and abiotic causes of plant diseases;
- host pathogen relationships, and the nature of resistance and pathogenesis;
- the application of molecular marker technology in pathogen identification, disease resistance and pathogen diversity;
- the processes leading to plant disease epidemics and their evaluation;
- the management and integrated control of plant diseases.

Practical work includes the identification and diagnosis of common diseases; and the development of skills in research techniques and methodology in plant pathology.

Assessment: Three-hour examination (60% of final marks), practical examination (10%), oral presentation (10%) and an assignment comprising a collection of plant diseases (20%).

Prescribed texts: J F Brown and H J Ogle, *Plant Pathogens and Plant Diseases*, Rockvale Publications, 1997. • G N Agrios, *Plant Pathology*, 4th edn, Academic Press, Harcourt/Academic Press, 2000.

208-308 Irrigation and Water Management

Availability: Dookie campus

Credit points: 12.5

Coordinator: TBA

Semester: Semester 1

Description: At completion of this subject students should be able to:

- describe the scale and distribution of the major irrigation systems in south-eastern Australia;
- evaluate plant water requirements in terms of water quality and frequency of supply;
- apply basic principles of hydraulics to the selection of irrigation systems appurtenances and structures;
- assess irrigation systems in terms of efficiency, economy, energy-use and environmental impact;
- recognise the advantages and disadvantages of common irrigation systems; and
- recognise the need for efficient irrigation drainage as well as water supply.

The content includes:

- water supply potential for the development of irrigation systems, management planning and operation of water allocations, water law, cost benefit analysis, environmental and energy-use implications of resource utilisation and development, efficiency of irrigation systems and long-term viability;
- climatic factors in irrigation development, rainfall, evaporation, evapotranspiration and hydrology;
- plant physiology and plant water use, transpiration crop water requirements in terms of water quality and quantity;
- soils and water, soil moisture retention and movement, plant root zones and development, infiltration and leaching;
- irrigation scheduling, soil moisture measurement; and
- types of irrigation systems, selection of irrigation systems, irrigation drainage, seepage, surface and subsurface drainage systems, salinity, conveyance and disposal of drained effluent, re-use systems, management of irrigation systems, operations and maintenance requirements.

Assessment: Three-hour examination (50%), a practical test (10%) and two assignments equivalent to 2500 words (each worth 20%).

208-320 Fertiliser Management

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Ken Young

Prerequisites: 202-201 Plant Function, 202-203 Soil and Water Resources

Contact: Thirty-six hours of lectures and tutorials including a five day block at Dookie (*Semester 2*).

Description: The objectives of this subject are to provide specialist knowledge on the fertiliser and soil ameliorant industries in Australia, and on systems of recommending and applying fertilisers to crops (grain, horticultural and vegetable) and pastures. This unit is designed specifically for students considering a career as an extension and/or research agronomist.

Subject content includes:

- factors affecting availability of macro- and micro-nutrients from soil and fertiliser; major nutrient and carbon cycles; role of major nutrients in plant and farm animal growth, with specific reference to grain, horticulture and vegetable crops and pasture based livestock production;
- overview of the Australian fertiliser and soil ameliorant industries; chemical fertiliser production and distribution; alternative fertilisers - biosolids, green manures, mineral fertilisers, other organic fertilisers; types and forms of fertilisers; physical and chemical characteristics and standards of fertilisers and soil ameliorants;
- interpretation of plant nutrient status including visual assessment and soil and foliar analysis; prediction of fertiliser responses using a range of systems including response curves, yield targets, nutrient mass balance and other predictive models; economics of fertiliser use;
- factors affecting availability of macro- and micro-nutrients from soil and fertiliser; major nutrient and carbon cycles; role of major nutrients in plant and farm animal growth, with specific reference to grain, horticulture and vegetable crops and pasture based livestock production;
- fertiliser application technologies for different forms and types of fertilisers; fertiliser mixtures and compatibilities; site specific application; time of application; risks and problems in fertiliser use and application systems; and
- environmental issues in fertiliser use; high or low input systems; nutrient transfer and off-site effects; interactions between plant nutrition and protection, sustainability issues associated with fertiliser use including soil acidification, structural decline, organic matter decline.

Assessment: One 3-hour examination (60%), two assignments equivalent to 3000 words (20% each).

Recommended texts: J S Glenndinning, *Australian Soil Fertility Manual*, CSIRO Publishing, Collingwood, 2000.

208-316 Oenology

See full subject details on page 4.

208-329 Viticulture

See full subject details on page 4.

208-337 Plant Protection Systems

Availability: Parkville campus

Credit points: 12.5

Coordinator: Prof Jim Kollmorgen

Contact: Equivalent to 24 hours of lectures and 36 hours of practical work, consisting of lectures, tutorials and flexible delivery and a 4-day practical block at the Dookie campus during the mid-semester break (*Semester 2*).

Description: This subject provides information on, and stimulates investigation of, the most significant diseases, pests and weeds affecting plant production in the cropping, pastoral and horticultural industries of south-eastern Australia, in an industry context.

Topics covered include:

- identification and taxonomy of pathogens, diseases and invertebrate pests;
- crop loss assessment and the economics of control strategies;
- strategies to limit production losses;
- environmental effects and social implications of control measures;
- interactions among and between pathogens, pests and weeds;
- integrated crop protection systems; and
- industry-based case studies including practical work on the management of weeds pests and diseases.

On completion of this subject, students should:

- have an understanding of the biology of the major biotic limitations to plant production;
- have the knowledge to choose appropriate control measures and make recommendations on the most economic crop protection systems;
- be able to explain and apply the principles of integrated crop protection systems;
- have the capacity to develop new approaches to plant protection as society and industry requirements change; and
- have communication skills to impart information on integrated plant protection to academia and industry.

Assessment: Three-hour end-of-semester examination (50%), four case-study reports (10% and maximum of 1000 words each) and oral presentation (10%).

208-339 Genetics and Animal Breeding

See full subject details on page 3.

Fourth-year electives

207-401 Soil Management and Conservation

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr Tony Weatherley

Prerequisites: 202-203 Soil and Water Resources.

Semester: Semester 1

Description: This subject will examine the major current issues in the management of soils under various land uses in Australia. The dynamic nature of the soils will be explored through study of the chemical, physical and biological processes in the soil environment, particularly those which impact directly on plant growth. The subject should develop an understanding of how soils can be managed to optimise plant growth and minimise adverse effects on the environment and present practical solutions to soil management.

Content includes:

- reactions of nutrients and contaminants with soil surfaces;
- processes controlling nutrient availability with particular reference to nitrogen and phosphorus;
- assessment of nutrient availability including quantity/intensity relationships;
- processes leading to sodic, salinised and acidified soils;
- soil structure classification and management to minimise erosion;
- water and solute movement;
- soil survey and land capability assessment;
- process-based soil management models; and
- soil contamination, urban soil issues and soil quality and sustainability indicators.

Assessment: A three-hour examination (60%), a major assignment of 3000 words (30%) and a class talk (10%).

207-404 Agricultural Policies and Trade

Availability: Parkville campus

Credit points: 12.5

Coordinator: Assoc Prof Donald MacLaren

Prerequisites: 207-101 Land, Food and Resource Economics, or 316-102 Introductory Microeconomics, 208-301 Agricultural Marketing. Consent from the subject co-ordinator is required for students not enrolled in Honours.

Contact: 24 lectures and 12 hours tutorials (*Semester 2*).

Description: On successful completion of this subject students should be able to:

- explain the reasons for government intervention in the agri-food sectors of several countries, including Australia, and identify the policy objectives being pursued;
- critically analyse the economic effects, including the trade effects, of the policy instruments employed;
- describe and analyse the limitations of applied welfare economics in guiding public policy;
- critically analyse the issue of world food security;
- explain the position of agriculture in the WTO;
- critically appraise the current proposals under negotiation;
- evaluate the newer issues in the WTO concerning the agri-food sector including trade and the environment, food safety, and multifunctionality; and
- synthesise the current policy issues in the agri-food sectors of the world economy.

The subject covers the following topics:

- the reasons for government intervention in the agricultural sector;
- the principal agricultural policy issues in Australia, the European Union, the United States and East Asia;
- the effects of these policies on international trade in agricultural products;
- agriculture on the GATT and the WTO - the built-in-agenda and the new issues being negotiated.

Assessment: A two-hour end-of-semester examination (60%), a mid-semester test (20%) and one assignment of up to 3000 words (20%).

207-410 Agroforestry

See full subject details on page 5.

207-413 Community Natural Resource Management

See full subject details on page 6.

207-414 Social Research Methods

Availability: Burnley campus

Credit points: 12.5

Coordinator: Dr Kathryn Williams & Dr Ruth Beilin

Contact: 35 hours of lectures and workshops, offered in block mode (*Semester 1*).

Description: Understanding of social process and action is critical to effective land management and social research skills are therefore valued by resource management agencies.

The subject aims to equip students with knowledge and skills to design social research which can be used to improve management of natural resources, agricultural and food systems.

The research process is considered step by step including scoping research issues, the evolution of research questions, and selection of appropriate methods.

A number of research strategies are considered in more detail including survey research, case studies and action research. Social research ethics, quality in social research and advances in social research methods are examined.

Assessment: A literature review of 3000 words and a research proposal of 3000 words each worth 40% of final marks, and a seminar presentation worth 20% of final marks.

Prescribed texts: A Bryman, *Social Research Methods*, Oxford University Press, Oxford, 2001.

208-402 Advanced Plant Breeding and Improvement

Availability: Parkville campus

Credit points: 12.5

Coordinator: Dr M Singh, Dr P Salisbury

Prerequisites: 650-142 Genetics and the Evolution of Life; and either 208-302 Molecular Biology, Breeding and Biotechnology or 208-307 Plant Pathology or other subjects as approved by course coordinators.

Contact: Twenty-four hours lectures and 36 hours practical work (*Semester 1*).

Description: Case studies are used to illustrate the steps involved in taking knowledge from research laboratory or breeding trials and producing and releasing novel crop varieties. This subject will include a small research project in an area chosen by each student.

Assessment: Three-hour end-of-semester examination (60%), written project report (4000 words, 25%), oral research presentation (15%).

208-407 Genetics and Animal Breeding

See full subject details on page 4.

208-409 Animal Welfare

Note: This subject involves the use of animals. Students should be aware that this is an essential part of the subject and exemption from this component is not possible.

Availability: Parkville campus

Credit points: 12.5

Coordinator: Prof Paul Hemsworth

Semester: Semester 1

Description: On completion of the course, students should have sound and broad understanding of the systems regulating body function and the behavioural and physiological responses utilised by animals in responding to environmental change. From this theoretical base, students should develop an appreciation of the scientific approaches available to assess animal welfare. Furthermore, students should understand the concepts of animal welfare and

be aware of the main welfare issues confronting animals in modern livestock production systems.

Specific topics covered include:

- the current debate about animal usage and animal welfare;
- systems regulating the body (homeostasis, motivation and control systems, and development of regulatory systems);
- limits to adaptation (stimulation, tolerance and coping, variation in adaptation);
- stress and welfare (Selye's concept of stress and refinements to the concept, coping and fitness, definition of welfare and its assessment);
- assessing welfare using short- and long-term biological responses;
- assessing welfare using preference testing;
- assessing welfare by studying cognitive skills;
- ethical problems concerning welfare;
- welfare issues in agriculture and the general community; and
- codes of practice for the welfare of livestock and welfare solutions.

Assessment: Three-hour examination (50%), a practical test (10%), and two assignments equivalent to 2500 words (each worth 20%).

Prescribed texts: D M Broom and K G Johnson, *Stress & Animal Welfare*, Chapman & Hill, 1993. • A F Fraser D M and Broom, *Farm Animal Behaviour & Welfare*, CABI, 1990.

